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N.S.W. BRANCH

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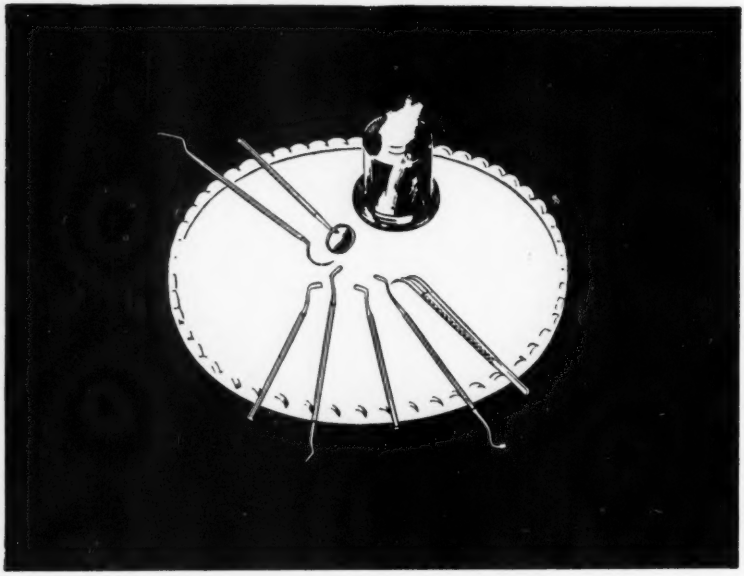

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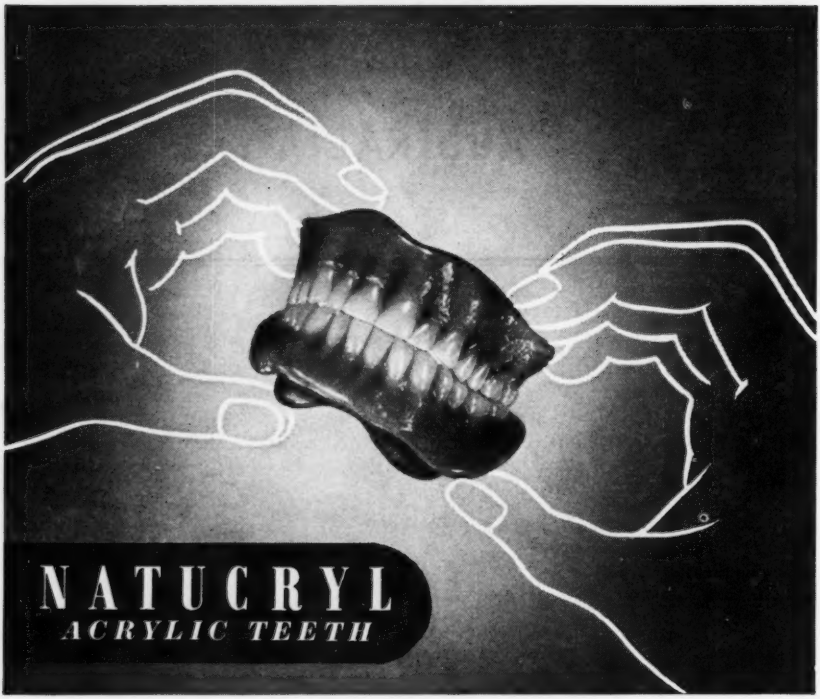

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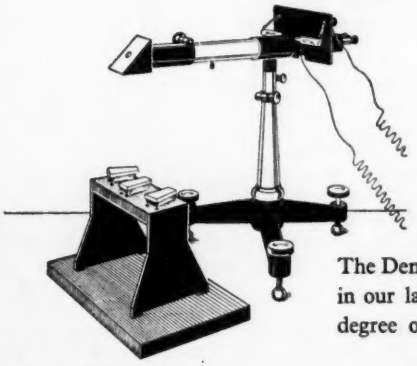

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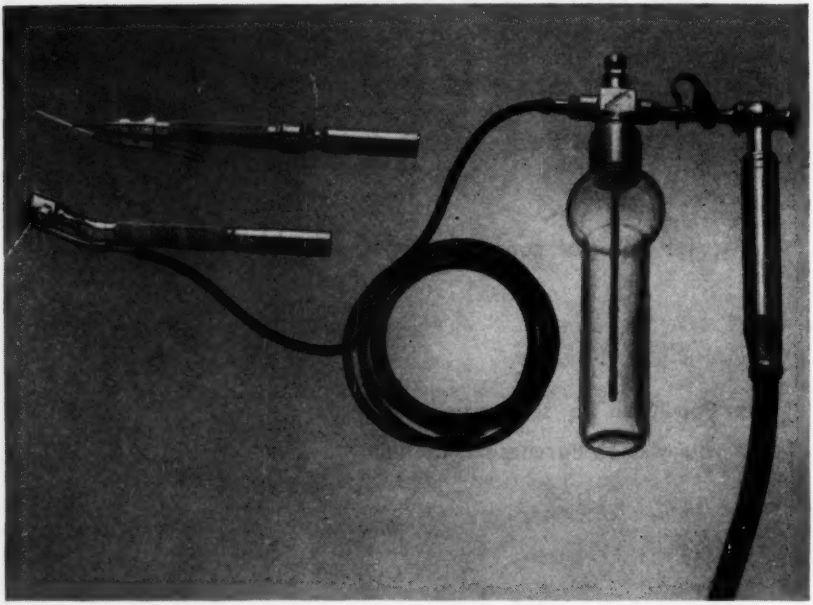

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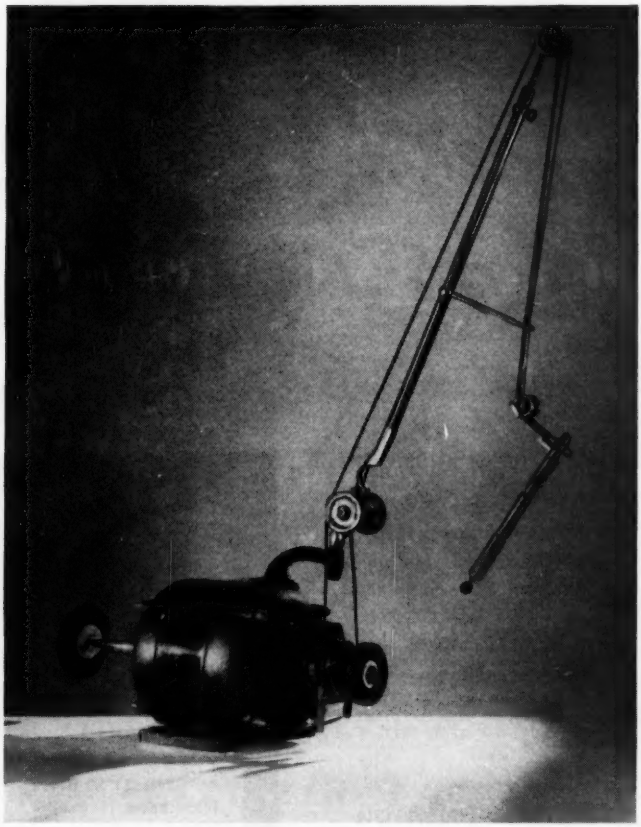

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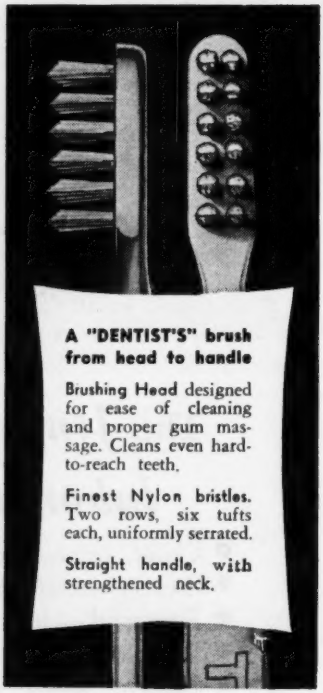
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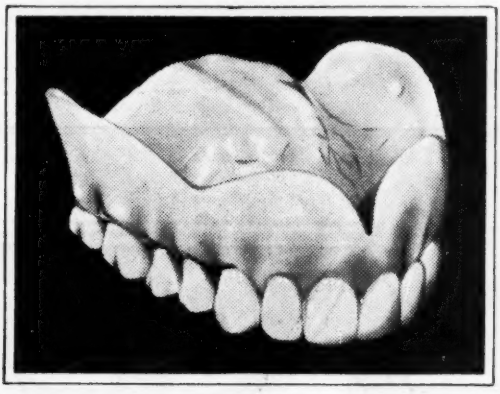

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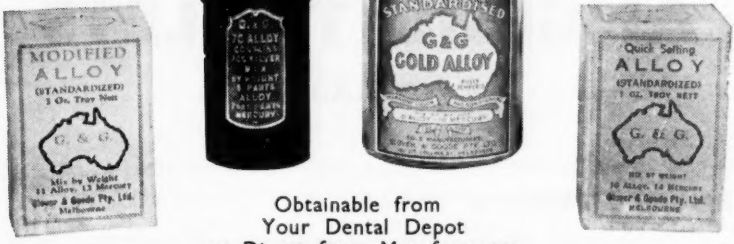

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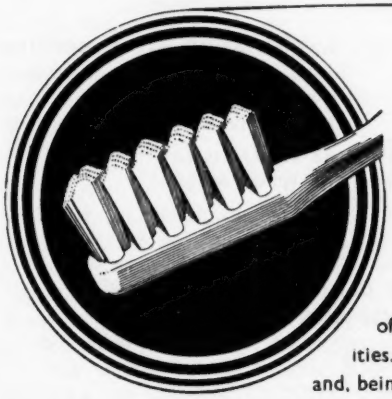

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The DENTAL Journal OF AUSTRALIA

Vol. 22 July, 1950 No. 7

THE RELATIONSHIP OF THE TOOTH'S ENVIRONMENT TO THE INITIATION OF DENTAL CARIES.*

By

B. LILIENTHAL, B.Sc., B.D.S. and MARGARET R. DEWAR, B.Sc.

Mr. Lilienthal: In the short time available it is impossible to discuss adequately all the constituents of the tooth's environment or indeed even those which at present may justifiably be considered as aetiologically related to dental caries. So, for convenience, the subject will be presented in three sections. Firstly, I shall discuss the localisation-mechanism and the substrates and enzyme-systems involved in the carious process. Secondly, Miss Dewar will discuss the factors involved in acid-neutralisation and thirdly, she will outline the chemical reactions which are concerned in the dissolution of the enamel.

IA. LOCALISATION OF THE INITIAL LESION.

Caries of the dental enamel occurs in well recognised sites: those which are not readily accessible to the flushing and neutralising activities of the saliva. It is in such areas that allegedly salivary mucoid (mucin) is precipitated onto the enamel surface, forming a firm, tenacious, rubbery film known as the "mucinous plaque." This structure localises a complex bacterial population against the crown of the tooth, permitting the micro-organisms a plentiful supply of nutrients while protecting their metabolic products from rapid dilution, neutralisation and dispersal by saliva, food and drink. A soft type of plaque is also formed on enamel surfaces but has properties different from those of the firm type.

These two varieties of plaques have been produced artificially on freshly extracted teeth by immersing them in saliva held at 37°C. The saliva was changed every 48 hours and, after a week, plaques had formed. Campaigne and Fosdick studied the pH of plaques produced in this manner and found that

*This paper was read at a meeting of the Discussion Group of the Institute of Dental Research, held at the United Dental Hospital, on 18th May, 1949.

both firm and soft types had a pH of about 4.0. However, after rinsing with sodium hydroxide, the pH of the firm rubbery plaques was still very low (5.50-4.38), whereas that of the soft plaques was high (7.15-10.40). Bruckner observed the dialysis of sodium bicarbonate through artificial plaques formed on cellophane and his results indicate that the plaque offers little resistance to the passage of this salt.

In the oral cavity, the pH of plaques drops rapidly when a rinse of either glucose, sucrose or starch is used, whereas rinsing the mouth with lactose causes the pH to drop slowly. All these substances then seem to pass through the plaques easily, although a large molecule, such as that of starch, might not be expected to penetrate the plaque very rapidly. It is known that the large starch molecule is readily degraded by ptyalin and thereafter its smaller components, particularly maltose and glucose, diffuse through the mucinous film.

Mucoid is precipitated at a low pH. However, it does not seem necessary to have a pH as low as that required for complete precipitation from saliva in order to have plaque forming on the teeth by the gradual deposition of mucoid. In the experiments by Campaigne and Fosdick (quoted above) the pH of the saliva and that of the plaque material corresponded very closely.

The bacteriology of plaques has had limited attention. Leon Williams was the first to describe many of the filamentous forms attached to the teeth. However, four decades after his work, very little more is known concerning these bacterial forms in plaques. Blayney, Bradel, Harrison and Hemmens have studied over a long period the flora of successive plaques formed at the same site. They found an increase in the incidence of lactobacilli with the onset of the carious process. A large variety of micro-organisms was isolated by these workers from the plaques but there appeared to be no direct relationship between any one type and the condition of the enamel surface. Recently, Stralfors in Stockholm found a direct correlation between low pH minima of plaques after using a glucose rinse and the presence of a large number of lactobacilli in the saliva.

Ib. Substrates.

Numerous substrates are found in the form of food debris at the sites of election of dental caries. Frequent ingestion of sweets, cakes and similar refined carbohydrates maintains a high sugar concentration in the saliva. The glucose and sucrose from these materials readily diffuse or are packed by mastication into the stagnation areas. Another source of fermentable carbohydrate is the saliva itself. Gore showed that (under conditions which hindered bacterial growth) mixed parotid and submaxillary salivas reacted to form a reducing sugar———a reaction in which the enzyme mucinase may be important because it is possible that the reducing sugar mentioned by Gore is split off mucin by this enzyme. In such an event, mucinase may be an important factor in the aetiology of dental caries.

Substrates which could be fermented to acid end-products are the polysaccharides (starch, inulin, glycogen and dextrins), disaccharides (sucrose, maltose and lactose), monosaccharides (glucose, fructose, galactose, mannose), many glucosides and polyhydric alcohols. The most important of these substrates are starch, sucrose and glucose. Ptyalin or salivary amylase readily

breaks down starch to maltose and some glucose may also be formed. Most of the starch remaining in the mouth has to be acted upon by ptyalin before the bacterial enzymes can operate. Fermentation of starch by mixtures of oral bacteria does take place to a slight extent but little is known of the mechanism involved. The enzymes of the numerous varieties of bacteria in the mouth are capable of fermenting a large number of carbohydrates.

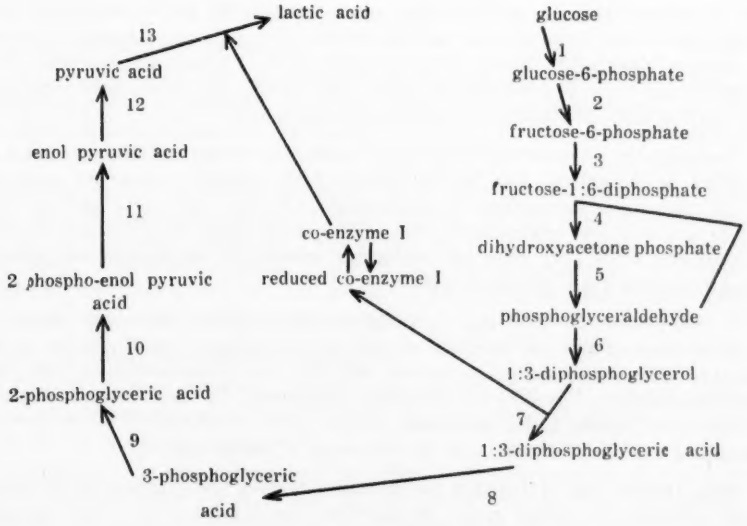
The saliva, besides providing a solution of many carbohydrates (carbon sources for bacteria) also contains many amino-acids and thus provides also an adequate supply of nitrogen for the micro-organisms.

All the essential amino-acids are present in the saliva as well as most of the non-essential and replaceable amino-acids.

Ic. Enzyme-systems in Saliva.

Ptyalin activity and its relation to dental caries have been studied by Hess and Smith. Among their conclusions is the following: "Salivary amylase activity in the same individual does not vary significantly from day to day. There was no significant difference between the salivary amylase activity of a series of twenty non-carious individuals and a series of thirty-six individuals with caries of varying degrees."

The enzymes in some bacteria are capable of converting the disaccharides to monosaccharides and then fermenting these six carbon atom molecules to three carbon atom acids. The steps in this process are shown in the following diagram.



Reaction	Enzyme required	Co-enzyme required	Reaction inhibited by
1	Hexokinase	adenosine triphosphate (ATP)	dialysis
2	Oxoisomerase	—	—
3	Phosphohexokinase	adenosine triphosphate (ATP)	dialysis
4	Zymohexase	—	—
5	Phosphotriose isomerase	—	—
6	? spontaneous reaction	phosphate ions	dialysis
7	Triosephosphate dehydrogenase	co-enzyme I*	dialysis or iodoacetic acid
8	Unnamed phosphokinase	adenosine diphosphate (ADP)	dialysis
9	Phosphoglyceromutase	—	—
10	Enolase	magnesium ions	sodium fluoride
11	Unnamed phosphokinase	adenosine diphosphate (ADP)	dialysis
12	? spontaneous reaction	—	—
13	Lactic dehydrogenase	co-enzyme I*	dialysis

*Co-enzyme I or diphospho-pyridine-nuclectide. This compound is composed of the following:—

phosphate —— D-ribofuranose —— adenine
phosphate —— D-ribofuranose —— nicotinic amide

This complex series of reactions enables the micro-organisms to receive a constant flow of energy. The importance of phosphate groups is evident; also the role of one vitamin, nicotinic acid, is shown. Sodium bisulphite considerably lowers acid-production in saliva by forming insoluble bisulphite compounds with aldehydes, thus breaking the chain of reactions. Sodium fluoride inhibits the enzyme enolase and thus inhibits acid-production.

It will be noted that pyruvic acid is formed before lactic acid and, as it is the stronger acid, may be the more important factor in enamel dissolution: Fosdick pointed this out many years ago. Lactobacilli and streptococci both produce lactic acid from glucose but organisms with different metabolic systems can produce other acids directly from pyruvic acid. Further possibilities, then, are the conversion of pyruvic acid to acetic acid, formic acid, oxalic acid, propionic acid, butyric acid or diacetal or alcohol or acetaldehyde.

Ammonia is a powerful antibacterial substance which may be produced in two ways in the saliva: (a) by the action of the enzyme urease on urea and (b) by bacterial deamination of amino-aids. Dreizen and Spies showed that some products of bacterial putrefaction of the amino-acids tryptophane, tyrosine and arginine were very effective inhibitory agents of the growth of aciduric micro-organisms such as lactobacilli.

In conclusion, I would like to indicate the necessity for closer study of the metabolism of the oral bacteria so that we can obtain a clear picture of the products. This study must, of course, embrace the investigation of the combined metabolism of groups of unrelated organisms. In short we must study symbiotic and antagonistic processes in the oral environment if we are to understand the role of bacteria in the initiation of dental caries.

Miss Dewar: Mr. Lilienthal has already stressed the importance of saliva in the aetiology of dental caries by showing the influence of saliva on acid-production, both localised in the plaque and in the saliva generally.

I wish to show how the saliva can influence the rate of the processes of dental caries also by neutralising the acid which, if not interfered with, will attack the tooth enamel.

II. Neutralisation of Acid.

The neutralisation of acid by the saliva is dependent on five main factors:

1. the buffering capacity of the saliva,
2. the rate of flow of saliva,
3. the physical features of the mouth,
4. enzymatic activity, which results in the production of basic compounds, such as ammonia,
5. the general chemical composition of the saliva.

1. The Buffering Capacity of the Saliva.

The buffering capacity of any solution determines the amount of acid or alkali which can be added to that solution without inducing any appreciable change in pH. For instance a saliva with a high buffer-capacity will change from pH 7.0 to 6.0 only when 1 ml of N/10 lactic acid is added. But, if the same amount of acid is added to a saliva which has a low buffer-capacity, the pH will probably drop to about 4.0. This is well below the point at which enamel dissolves. So it can be seen that bacteria could more easily lower the pH of a poorly buffered saliva than of a highly buffered one.

The buffers in the saliva are mainly sodium carbonate and bicarbonate, and sodium and calcium phosphates. The chemical composition of the saliva is, then, important in determining the buffering capacity and indirectly affects the neutralising power of the saliva.

2. The Rate of Flow of Saliva.

The rate of flow of saliva also affects acid-neutralisation. If there is a large volume of saliva secreted, it can neutralise more acid than would be possible if a small volume is secreted (provided the change in flow does not alter the chemical composition, etc.).

A high rate of flow can, according to *in vitro* observations at least, overcome the disadvantages of a low buffer-capacity, i.e., the quantity compensates for the poor quality. Whether this is true also in the mouth has not been established. Fosdick tried to assess a person's susceptibility to caries by estimating the product of the rate of flow of the saliva and the buffer-capacity, but he did not obtain satisfactory results.

3. The Physical Features of the Mouth.

This third factor, which I have listed as affecting acid neutralisation in the saliva, may partly explain why Fosdick did not get a satisfactory correlation in the test I have just mentioned.

If teeth are in good alignment, the saliva will have easy access to a large area of tooth surface. But if any barriers exist, either from restoration or malposed teeth, saliva cannot easily enter these areas and so any acid produced there will probably not be neutralised. In such circumstances the quality of

the saliva is of particular importance, because if any saliva at all does reach these areas and if it is highly buffered, it will offer more protection to the tooth-surface than if it were poorly buffered. A fast rate of flow would probably be no more effective in such circumstances than a slow rate.

4. Enzymatic Activity Which Results in the Production of Basic Compounds.

The fourth factor which influences the neutralising power of saliva is the breakdown of protein to basic compounds. Mr. Lilienthal referred to this earlier.

Bacillus aerogenes, an ammonia-producing organism, has been isolated from saliva. Also other bacteria have been isolated which can break down some of the amino-acids present in saliva to ammonia. Such ammonia can directly neutralise any acid present.

It has also been established that the enzyme urease is present in saliva. Hence, if any urea is produced by bacterial action, the urease will convert it, too, to ammonia.

5. The General Chemical Composition of the Saliva.

I have mentioned the buffer-capacity of saliva and referred to the indirect effect which the chemical composition of saliva has on dental caries. The easiest way to explain the direct effect of the chemical composition of saliva on caries is to show what chemical changes are believed to take place in the saliva at the onset of caries.

III. REACTIONS CONCERNED IN THE DISSOLUTON OF ENAMEL.

From the biochemists' point of view dental caries results when the rate of acid-production is greater than the rate of acid-neutralisation, so that the pH is able to drop below 5.0. At this hydrogen ion concentration, the tooth enamel begins to dissolve. In order to understand what happens and what factors are involved, it is best to consider what occurs when calcium phosphate, $Ca_3(PO_4)_2$, is shaken with water. A very small amount of calcium phosphate goes into solution till an equilibrium is finally reached. This may be expressed as follows:

i. $Ca_3(PO_4)_2$ (solid) $\rightleftharpoons$ $Ca_3(PO_4)_2$ (saturated solution) $\rightleftharpoons$ $3Ca^{++} + 2PO_4^{\equiv}$

It is known that the product of the concentration of the ions in a saturated solution of a relatively insoluble salt is constant, *i.e.*, the product of concentration of the Ca^{++} and $PO_4^{\equiv}$. This is expressed chemically as:

ii. $[Ca^{++}]^3 \quad [PO_4^{\equiv}]^2 = K_{s.p.}$

This constant is called the Solubility or Ionic Product Constant, and until it is satisfied, provided that solid salt containing the necessary ions is present, the reaction (i) goes to the right, that is some of the solid dissolves. But once this constant is satisfied, *i.e.*, once the required number of ions have gone into solution, no more of the solid will dissolve.

If, however, acid, *e.g.*, hydrochloric acid (HCl) is added to the saturated solution of calcium phosphate there will be

iii. Ca^{++} $\quad$ $PO_4^{\equiv}$
H^+ $\quad$ Cl^-

Because $PO_4^{\equiv}$ is a weak ion, H^+ reacts with the $PO_4^{\equiv}$ and $HPO_4^{=}$ and $H_2PO_4^{-}$ are formed. But $K_{s.p.}$ is a constant. Therefore, if the $PO_4^{\equiv}$ concentration decreases, the Ca^{++} concentration must increase: more calcium phosphate therefore dissolves to effect this increase.

Analysis has revealed that saliva with a pH higher than 6.5 is saturated with calcium phosphate. But, when the pH falls, *i.e.*, with the advent of the H^+, the $PO_4^{\equiv}$ ion-concentration drops, due to the formation of $HPO_4^{=}$ and $H_2PO_4^{-}$ ions; thus the saliva becomes unsaturated. It then draws on the calcium of the enamel so that the product of the concentrations of the Ca^{++} and $PO_4^{\equiv}$ attains to the value $K_{s.p.}$ Dissolution of the enamel, or dental caries, results.

So it can be seen that the ionic concentrations of calcium and phosphate and the pH of the tooth's environment are of great importance in the initiation of caries and any factors that influence these three things are of importance in the aetiology.

I hope Mr. Lilienthal and I have been able to show clearly how acid is produced, with a corresponding change of pH in the mouth, and how the Ca and PO_4 ion-concentrations are thus altered and then readjusted in accordance with the principle of the Solubility Product Constant at the expense of the tooth-surface.

Dr. Goldsworthy: This subject is now open for general discussion.

Miss Dewar: I should like to know, Mr. Lilienthal, whether pyruvic acid has been isolated from sites within the mouth; you mention pyruvic acid as a step to lactic acid in the acid cycle.

Mr. Lilienthal: No, it has not.

Miss Dewar: Then, from the practical point of view, it looks as if lactic acid must be regarded as the most important acid?

Mr. Lilienthal: It is possible that there are acids other than lactic acid concerned in the dissolution of the enamel; not all organisms within the mouth can produce this acid. It is also possible that, as conditions become more acid, certain organisms change their metabolism to produce substances which are alkaline and therefore tend to raise the pH of the saliva to its previous level. In other words the environment can alter the metabolism of many bacteria.

Dr. E. S. Wallace: One realises from these talks the involved process concerned in the degradation of carbohydrates to a form in which they can attack the calcium phosphate of the tooth. It has been shown that a comprehensive knowledge is necessary to approach this subject of dental caries. From the angle of the practical application of this knowledge the necessity is obvious for finding some factor which will interrupt the chain of events at some convenient point and thus inhibit caries. Mr. Lilienthal has pointed out one such possibility: it is likely that some other chemical substance will also be found which is able to interrupt the series at another point in the chain, perhaps earlier. The talk illustrates that the approach to the prevention of dental caries in a practical way must take into account every factor involved. The physical relationship of teeth to one another in the mouth is an important factor, hence preventive dentistry must aim at restoring the whole mouth into as normal a condition as possible.

Mr. Lilienthal: With regard to the use of sodium bisulphite to prevent acid production in saliva: this is a substance which readily produces insoluble compounds with aldehydes. Experiments on acid-production by whole saliva have been carried out in the presence of sodium bisulphite. The results indicate that acid-production is much reduced but the workers did not commit themselves as to which step in the process was affected by the bisulphite. All the evidence points to 3-phosphoglyceric-aldehyde as being put out of action.

Mr. L. O. Martin: I cannot agree with the implication that the solubility product of calcium phosphate is stable in the mouth. You can deduce by appeal to physical chemistry that the solubility product is constant only if you have a constant environment; but under conditions of the mouth the environment cannot be said to be constant. If you increase the ionic concentration in the aqueous phase you always increase the solubility product. The change in solubility product will depend on the kind of ions added. Has the saliva of a normal person a higher concentration of one species of micro-organisms than another? Can phosphorus be obtained from phosphorus of the tooth enamel?

Miss Dewar: As far as we know, enamel is not pure calcium phosphate, therefore we are not able to obtain a true solubility product for enamel, but to explain this phenomenon to persons who have not a knowledge of chemistry we are in the habit of simplifying the reasoning. Another difficulty in endeavouring to give a simple explanation is that the calcium ion concentration in the calcium phosphate complex is uncertain, because all we can determine is the calcium concentration and not the degree of ionisation: this keeps the whole problem in the theoretical field rather than the practical.

Mr. Lilienthal: With regard to the phosphate ions required at different stages—adenosine triphosphate looks after the supply of phosphate radicals but at one stage inorganic phosphate ions are needed. It should be possible in that part of the cycle to use other sources of phosphate ions such as those present in saliva—in theory at any rate.

Mr. L. O. Martin: Is there any evidence that some people have more ions in saliva than others?

Miss Dewar: There is quite a controversy as to whether the concentration of calcium or phosphorus in the saliva has anything to do with caries. One school says there is a significant difference between persons who are immune and those who are susceptible and another school says this may be a chance impression because such factors as the rate of flow of saliva have not been taken into account; but that, if we could control these factors, we might find a significant difference. It is still rather a controversial subject.

Dr. Goldsworthy: Patterson published work that showed that an increase of vitamin D increased the concentration of calcium phosphate in saliva.

Miss Dewar: Karshan has disproved that.

Dr. Freeman: Is that rubbery mucinous plaque permeable to sodium fluoride?

Mr. Lilienthal: Nobody has performed experiments to test that, but fructose, glucose and other substances do permeate the plaques.

Mr. L. O. Martin: Would it not be the products of the decomposition of glucose, fructose, etc., which pass through rather than the sugars themselves?

Mr. Lilienthal: That is a question I have been interested in myself. The use of the cellophane technique would be an easy way of testing it but as far as I know at present such an experiment has not been done. Bruchner did say he was continuing his research on other aspects of the problem but there has been no published report so far.

Dr. Freeman: Is any other substance used in conjunction with sodium fluoride in order to reduce the surface tension and thus promote spread to otherwise inaccessible surfaces?

Mr. Lilienthal: I do not think so. Variation in the concentration of sodium fluoride has been tried but little else has been done. I am not aware of all the work on topical application but there are differences of opinion as to whether we should or should not clean the teeth before applying the solution.

Dr. Freeman: It sounds all right to clean the surface of the teeth and then apply the solution but the topography of the mouth must make a difference.

Mr. L. O. Martin: A detergent would only clean the teeth, not help to spread the fluorine.

Mr. Lilienthal: Another aspect of the fluorine story is that amino-acids yield different substances which hinder the breakdown of carbohydrates; one writer suggested that fluorine replaces iodine in tyrosine and thereby inhibits that substance from forming thyroxin.

I think we tend to stress acid-production and the carbohydrates too much. If we ascertain all that can happen to amino-acids in saliva, a lot more may be learned of the process of caries. Mucin itself may be responsible; there may be many tyrosine residues in the protein complex. Fluorine may be able to substitute in that structure and so may produce a marked effect, mainly in close proximity to the tooth itself.

Mr. Sullivan: Looking at things from the chemical aspect, can you give us any details regarding remineralisation. Wolf claims to have observed an amorphous deposit of calcium phosphate on early lesions. Would such a claim be at variance with any principles of chemistry?

Miss Dewar: As regards remineralisation, it seems to me that if enamel can dissolve the reverse should be able to occur; but there are arguments against remineralisation of the teeth. However from a chemical point of view it should be possible.

Dr. Goldsworthy: Formation of calculus is that process, is it not?

Mr. Lilienthal: A change in conditions of local environment would allow precipitation.

Miss Dewar: Ford says the solution of calcium phosphate is concerned in the arrest of caries: he thinks remineralisation occurs and the process is arrested.

Dr. Goldsworthy: We have learnt that the micro-environment of the tooth is a very complicated thing. Cox has put into print what we have taught here for many years, viz., that we must begin to think in micro-dimensions rather than in terms of gross masses and visible changes. Until we do so, we are not even beginning to solve this problem. This discussion should be carried further and I hope an opportunity will arise for us to continue it in more minute detail. I should like to thank the speakers very much for leading our deliberations.

TRI-COLOUR PHOTOGRAPHY.

An Outline of Principles Involved and Concluding with some Practical Procedures and Methods Adopted in Clinical Medical and Dental Practice.

E. SLATER.*

INTRODUCTION.

In medical and dental photography and in the other fields of scientific endeavour colour photography has proved to be a valuable aid to clinical diagnosis in teaching and as a means of recording results of research.

Photography in these spheres of work has to be developed along carefully standardised lines rather than from the aesthetic approach.

Colour photography, in science more than in any other photographic pursuit, requires attention to technical details and standardised procedures.

It is in this light that I offer you these working suggestions, in order that the many factors involved may be reduced to a minimum, ensuring perfect control over the apparatus and materials used. The aim in colour photography of this nature, if you place it in the category of an exact science, is to be able to reproduce one's results without variation.

Firstly, it is proposed to deal as briefly as possible with the basic principles around which colour photography has evolved. These only claim to be an outline, and it is suggested that the literature cited should be entirely perused in order that one may approach the subject of colour and see it in its true perspective.

Most importance is placed on integral tripack materials such as Kodachrome for example, as these are the most practical materials to use in dental work. If it is felt that colour printing involving separation negatives is required, then such information would be gladly communicated. However, the references will fully cover this subject.

Apparatus required, including cameras, lighting equipment and processing materials, will be dealt with, as will the most suitable means of making use of these things.

Finally, processing formulae will be set out, together with a complete bibliography for reference purposes.

Colour photography is generally presumed to be a new development extending over the last decade. On the contrary, the principles involved were known as far back as 1861, Clerk-Maxwell having propounded his theories on colour and produced what was probably the first coloured photograph.

Two methods exist, based on three-colour synthesis—one additive and the other subtractive.

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ADDITIVE PHOTOGRAPHY.

Additive photography consists of making three separate negatives with red, green and blue filters and the resulting positive images, when projected through the three, taking filters in such a way that each image coincides in register with the other, produce a picture in natural colour.

A more practical method using the additive principle is used for Dufaycolor film, obtainable readily in Australia. Here the film base is covered with a geometrical pattern of microscopic red, green and blue filters. The emulsion is, of course, panchromatic—that is, sensitive to red as well as other colours. Exposure is made through the base of such a film. Red light from the subject would be transmitted by the red filter and absorbed by the green and blue filters; green light from the subject is transmitted by the green filter and absorbed by the red and blue, and so on.

Where light is transmitted, a silver density is formed behind that particular filter. Light absorbed would leave unaffected silver salts behind the respective filters. The developed image would form a negative. When this negative image is reversed to a positive image in processing, a clear area would exist where light was transmitted by the filters and an opaque silver density where light was absorbed.

When viewed as a transparency, by transmitted light red areas in the original subject will appear red, as the light is transmitted by the red filter components, whereas the blue and green filters have an opaque silver density behind them. Records of blues and greens are reproduced in a similar manner.

SUBTRACTIVE PHOTOGRAPHY.

In additive photography a picture is built up by adding colour. In nature, substances are not coloured in this way but instead they absorb or subtract certain portions of the visible spectrum of white light and reflect the remainder. It is this composite reflected portion which is the colour the eye records as the natural colour of the object, and this phenomenon is the basis of the subtractive processes.

This system is somewhat different from additive photography and is more commonly employed in three-colour photography, including the production of three-colour blocks in the printing trade.

Three-colour separation negatives are made through standard red, green and blue tricolour filters. A negative made with a red filter would record only the red colours from the subject and reproduce them as a silver image. The clear areas of the negative represent the other two colours absorbed by the red filter, namely, green and blue, or cyan as such a combination is called. Likewise, silver densities in a positive print from this negative would represent the blue-greens and could be toned this colour by suitable means.

A positive from a green filter negative would be a record of the blue-reds, or magenta as it is known. A positive from the blue filter negative will be a record of the red-green or yellow. If prints from the three negatives are toned in a suitable way and are super-imposed in register, a natural colour photograph will result.

Red, green and blue may be regarded, for purposes of colour photography, as primary colours and their complementaries are as follow:—

Primary.	Complementary.
Red	Blue-green, or cyan.
Green	Blue-red, or magenta.
Blue	Red-green, or yellow.

METHODS EMPLOYED.

The basis of subtractive tricolour photography lies in the making of correctly exposed separation negatives. This is not the simple matter that it may appear at first sight. A large number of factors are involved and must be controlled within fine limits. Among them are spectral emission of light sources, colour temperature, filter ratios, spectral sensitivity of photographic emulsions employed, control of gamma or contrast in processing, etc., to mention but a few. For further explanation, it is suggested that some of the literature quoted at the end of this instruction should be referred to—in particular, Friedman's *History of Color Photography.*

SEPARATION NEGATIVES.

It will appear from the above discussion that, in order to produce photographs in colour, it is not necessary to resort to colour films. By producing three separation negatives on panchromatic material, prints or transparencies can be produced, provided suitable methods can be used in order to produce the necessary positive coloured images.

In making separation negatives the most important requisite is a set of three balanced negatives. Variation in density is not of great importance but each negative must match the other in gamma or contrast. It must first be realised that density in a negative is governed by exposure only, and contrast by time and temperature, type of developer, etc., used in processing.

To understand this fully and in order to understand the fundamentals in colour photography, the science of sensitometry should be studied.

The only way in which satisfactory negatives can be made is on a purely scientific basis. There is no room for empiricism in colour photography.

Each negative should be made with a calibrated reflection step-wedge or gray scale included in the subject matter.

When densities of the gray scale are reproduced on the negative, measured on a densitometer and plotted against the densities of the original gray scale, the characteristic curve will be given for the particular emulsion under the conditions of a particular method and form of development.

The interpretation of the result will give information regarding contrast or gamma, density, under- or over-exposure. In a correctly exposed and developed set of separation negatives the straight line portion of the characteristic curve of each of the three negatives should coincide or, at least, run parallel to each other.

The slope of the curve denotes contrast or gamma and is expressed as the tan of the angle to the log exposure axis.

Having secured a satisfactory set of separation negatives, positive prints are then produced from them.

Before considering paper prints and transparencies, the various methods available for producing positives in colour will be dealt with.

(1) *Chemical Toning Methods.*

Various reactions exist which enable the silver of the positive photographic image to be replaced by a coloured substance. One example with which everyone is familiar is sepia toning of a photographic print by replacing the silver of the image with silver sulphide. It has been found practical to produce transparencies and prints on paper in colour by replacing silver with cadmium sulphite or lead chromate for yellow, nickel glyoxime for magenta, and iron ferrocyanide for the cyan image.

The most popular form of toning starts with the conversion of the silver image into a mixture of silver and some other insoluble metal ferrocyanide.

The chemistry of such a method is as follows:—

$$4Ag + 4K_3Fe(CN)_6 \rightarrow Ag_4 Fe(CN)_6 + 3K_4Fe(CN)_6$$

If an ion is present in the toning solution which precipitates silver more easily than the ferrocyanide, then it becomes possible to use all the ferrocyanide. The reaction proceeds as follows:—

$$4Ag + 4K_3Fe(CN)_6 + 8Ni(Br)_2 \rightarrow 4AgBr + 4Ni_2Fe(CN)_6 + 12KBr$$

All four molecules of ferrocyanide are precipitated as a nickel salt which can then be converted to a magenta colour with dimethylglyoxime.

(2) *Dye Toning.*

This may be accomplished by treating the silver image in such a way as to produce a colourless mordant to which a basic dye will firmly adhere.

Copper and uranium salts may be used for mordanting a transparency or print. Dyes suitable for three-colour photography may be selected from the following:—

Magenta.	Yellow.	Cyan.
Rhodamine B	Auramine	Capri Blue
Rhodamine S	Thioflavine F	Methylene Blue
Pyronine G	Thioflavine T	Thionin Blue

Basic dyestuffs, however, are not very stable to heat or light and, although brilliant images result, it is not considered to be a satisfactory approach to colour.

(3) *Imbibition Processes and Dye Transfer.*

This is the basis of the Technicolor process. Gelatin relief images are formed, known as matrices. A special material known as matrix film is used in the case of Kodak dye transfer and wash-off relief. The separation negatives are printed onto this film and either developed with a tanning developer such as Pyrogallol or developed with a Metol Hydroquinone developer and bleached in a tanning bleach. This renders the gelatin in the vicinity of the silver image insoluble in hot water. Those portions of the print unaffected by light will be dissolved away on washing in warm water, thus forming a photographic

image in gelatin ranging in thickness as was the density of the silver image. This gelatin is capable of absorbing acid dyestuffs and these can be transferred to a specially prepared paper base to give a colour print, or the dyed reliefs bound in register to form a transparency.

(4) *Dye-coupling Development.*

Of all the methods that have been adopted in the past for three-colour synthesis (and the above only represent a few), dye-coupling development and dye transfer processes for transparencies and prints are the systems most widely used today.

Dye-coupling is the method used in the production of Kodachrome, Ektachrome, Kodacolor prints, Ansco and Agfa colour.

Dye-coupling is brought about by the oxidation of paraphenylene-diamines and related aromatic amines in the presence of phenols, cresols, naphols, etc.—so-called dye-couplers.

The paraphenylene-diamines also act as developers and so the reduction of silver salts brings about the necessary oxidation and, when development is carried out in the presence of dye-couplers, insoluble dyestuffs are formed along with the silver image. On removing the silver with a suitable solvent a coloured dye image remains.

For three-colour photography suitable dye-couplers are selected in order to produce the cyan, magenta and yellow images.

Integral Tripacks.

Kodachrome material is processed by the manufacturer. It consists of:—

I. A blue sensitive layer.

II. A yellow filter layer.

III. A green sensitive layer.

IV. A red sensitive layer.

V. The cellulose acetate base.

After exposure, the film is processed in the following manner:—

a. Developed as a negative.

b. Hardened, and the red sensitive layer exposed to red light and developed with a cyan dye-coupling developer.

c. The blue sensitive layer is then exposed to blue light and developed with a yellow coupling developer.

d. The centre or green sensitive layer is then exposed to white light or chemically fogged by a substance such as methylene blue, and developed with a magenta dye-coupling developer.

The film would now be completely black—consisting of both the silver negative and positive images, along with the dye image. When the silver is dissolved, a dye image remains and so produces a picture in natural colour.

Anscocolor is similar to Kodachrome in that it is a tripack emulsion; however, it differs in one respect—that it requires only one dye-coupling development, thus simplifying processing technique.

In Kodachrome, dye-coupling substances are added to the colour developer. In Ansco, dye-couplers are incorporated in the appropriate layers of the emulsion. In order to prevent the dye-couplers from diffusing from one layer to another, long chain molecules are attached to anchor them.

In Ektachrome, which is in many respects more closely similar to Ansco, the dye-couplers are anchored by being encased in possibly a polyvinyl resin which is water-permeable.

TYPES OF COLOUR FILMS.

Integral tripack materials such as Kodachrome are manufactured to be used with light sources conforming to certain standards. With 35mm. Kodachrome—Daylight Type—the film is used under daylight conditions, being balanced to give correct colour rendition in noonday sunlight with no clouds.

Under artificial light a different type of film known as Kodachrome Type A is used. This is balanced for a colour temperature of 3400° Kelvin, of which more will be said later. It is necessary to use a light source of 3400° K. with Type A Kodachrome and maintain it at that spectral quality, in order to obtain faithful colour reproduction.

Ektachrome Type B and Anscocolor for artificial light are balanced to be used with a light source of 3200° K.

FORMS OF ILLUMINATION.

(1) *Photoflood lamps.*

These lamps provide the most economical source of light for colour photography. The No. 2 Osram type of 500-watt over burnt filament, giving an output of about 1300 candle-power, will be found suitable.

The life of the lamp is approximately 9 hours. In order to preserve it, a series-parallel switch should be built into the circuit when two or more lamps are being used. When focussing or arranging lamps, it is more convenient to burn them at half intensity.

Colour Temperature.

At this stage it is necessary to describe colour temperature—how it may be controlled and the effect on colour photographic results.

Colour temperature of a source of light is the temperature to which a perfect black body must be operated to give a colour matching the source in question. A black body is a radiator of uniform temperature whose radiant flux in all parts of the spectrum is the maximum obtainable from any radiator at the same temperature.

Colour temperature is denoted by degrees Kelvin or the absolute Centigrade scale.

These artificial light sources commonly used for colour photography have the following colour temperatures when operated at the recommended line voltage:

Philips Argaphoto	240V.	3200°K.
Osram Photofloods No. 2	240V.	3400°K.
Philips Photoflux Flashbulbs	—	4000°K.

A simplified explanation of colour temperature would be that, when an electric lamp stated to burn at a particular colour temperature at a given voltage is used at a lower voltage, the ratio of red at one end of the spectrum would be greater to the blue at the other end as emitted by the lamp.

Therefore, as an example, when Type A Kodachrome is used with 3400°K. Photofloods to which it is balanced, it is necessary to maintain the voltage at that prescribed (240 Volts). If it is lowered, the photographic results will be off-balance and on the red side. If the voltage is raised above 240 Volts, the photographic results would be on the blue side.

In order to maintain the correct colour temperature when using floodlights for colour photography, a voltage stabilizer or auto-transformer should be placed in the circuit. Even a transformer manually operated with a voltmeter could be used in order to control the line voltage. This is a most important consideration when colour photography of a scientific nature is to be carried out to any extent.

It will also be found that colour temperature of lamps will vary with age and long continuous burning at normal voltage. Wherever possible, Photofloods known to have been used a great deal should be avoided, unless other measures are adopted.

Colour Temperature Meters.

A means of checking colour temperatures is by the use of a colour temperature meter, of which the Eastman Colour Temperature Meter may be taken as an example.

When this is used in conjunction with a set of colour-compensating filters, the degree K. can be raised or lowered to the desired degree.

It is possible, therefore, to use lamps other than photofloods. This may be found useful when working in the operating theatre. By the use of the colour temperature meter a suitable C C filter can be selected to bring the theatre lighting to the spectral quality required. This may considerably simplify the photography in colour of certain types of surgery.

The C C filters are supplied in blues for raising the degree K. of the light source and amber for lowering the degree K.

(2) *Flashlight in Colour Photography.*

Possibly the most satisfactory souce of light for colour photography of clinical subjects, etc., is the flashlight. Among the advantages, the patient's comfort is increased, which is an important consideration. Floodlights can be very distressing to some people.

Flash bulbs today are manufactured with great precision, and accurate exposure is readily obtained. They represent the most standard form of light source as regards colour temperature, duration and intensity of light, etc. The flash at the camera position will give the ideal flat lighting desirable for colour photographs.

In using flashlights it is necessary, also, to correct the colour temperature by means of colour-compensating filters. In the case of Philips Photoflux of 4000°K., a Kodak C C 15 filter will be found satisfactory for use with Kodachrome Type A film.

EXPOSURE.

Exposure in colour photography is critical, and an accurate means of determining it is necessary. I consider an exposure meter, intelligently used, essential.

There are various methods of using light meters and, although two schools of thought exist regarding the method for determining correct exposure with colour materials, I will refrain from becoming involved in any argument for or against.

Instead those methods will be outlined which have proved most satisfactory in the varied field of clinical photography.

For colour photography the two methods used are:—

i. To measure the incident light falling upon the subject—for which special meters known as highlight meters are available.

ii. To measure the light reflected from the subject.

Where the range of brightness is not great and one is dealing with one kind of subject matter, such as recording colour of teeth and surrounding structures and most other subjects found in the clinical practice of photography, the highlight system is the method that will give the most consistent results.

A Weston Master Meter is considered the most useful and reliable meter for general use. For highlight reading, the light reflected from a white card, such as the back of a 10″ x 8″ sheet of white bromide paper, placed in the position of the subject is determined. The film speed is divided by a factor of five. Therefore, when using Kodachrome Type A with a Weston speed rating of 8 in artificial light, a Weston rating of 1.5 will be found correct when using the white card system. One should hold the meter in such a way as to avoid casting a shadow of the meter, etc., on the card, which would result in an inaccurate reading.

When using floodlights, it is suggested that the lights be adjusted in position in order to give an intensity of 400 foot candles as shown by the Weston Meter reading from the white card. More consistent results will be obtained if the lights are adjusted to give this standard intensity of illumination than if a different reading and exposure is used each time a photograph is taken.

Weston film speeds given in the booklet accompanying the meter should be followed. However, these can only be regarded as guide numbers for colour, and it will be found best to calibrate one's own exposure meter for use with a particular camera. It is not uncommon for individual meters to give different readings.

As regards exposure for colour, another point worth mentioning is that, when using colour material, you should select one shutter speed for all work and vary exposure by opening or closing the iris diaphragm. This will overcome any inaccuracy in the shutter speeds, as stated in the camera. Slower speeds, ranging from 1/10 sec. to 1/50 sec., should be used as these are more likely to be correct.

Whilst still on the subject of exposure, there is one other matter requiring strict attention. A great deal of work will be done requiring close-up focussing. This necessitates the extension of the camera objective or lens up to twice the

A 9 cm. or 13.5 cm. objective is desirable and is very convenient to use in oral surgery, enabling the camera to be placed at a greater distance from the field, and also simplifying the adequate illumination of the oral cavity.

For close-up work down to 17½", in more generalised photography an optical near-focussing device—"Nooky"—is available for attachment to the Leica camera, coupling the 5 cm. objectives to the range-finder.

For close-up work, the most satisfactory piece of apparatus is the sliding copy device. This may be used with all focal length objectives and with extension tubes. The image of the subject is accurately focussed on a ground-glass screen, by means of a magnifier. The camera may then be moved into the position of the ground-glass screen and the exposure made.

At all times, a lens hood should be used. If a selection of lenses are available, a lens hood of the type that can be extended should be chosen. The use of a lens hood is not merely to prevent stray light from striking the lens surface but, more important, to allow only that portion of the ilght reflected from the subject to enter the camera, thus eliminating undesirable light reflections inside the camera.

LIGHTING EQUIPMENT.

Floodlights.

The most satisfactory and economical lighting equipment for colour photography, where only a small area is required to be illuminated, is the Kodaflector unit. The "Kodaflectors" are made of highly polished aluminium of a conical shape and provide a most intense source of light. This means that smaller apertures can be used, resulting in greater depth of focus. Narrow reflectors do not allow sufficient escape of heat and the life of the Photoflood lamp is greatly reduced.

The Eastman Medical Spotlight forms a satisfactory illuminant for lighting deep cavities. With Kodachrome Type A, the colour temperatures will have to be adjusted.

Flashlight.

For flashlight work with the Leica, the best equipment available is the Leica Flash Synchronizer. This is a precision-built synchronizer, enabling flash exposures to be made down to 1/1000 sec. It would be wise to procure this apparatus if much work with the Leica is to be carried out. The initial cost may seem high, but the problems associated in synchronizing a flash lamp with focal plane shutters are great. In diaphragm shutters, flash bulbs are easily synchronized but, in a focal plane shutter with a slit in a roller-blind travelling across the plane of the film, any inaccuracy involving synchronization will result in a fading-off or under-exposure on one end of the pictures.

It is possible to make flashlight pictures by placing the camera on a stand, opening the shutter on time or bulb, and then firing the flash lamp, though this may prove inconvenient at times.

If using a larger plate camera, it would be worthwhile to have it fitted with a shutter such as the Kodak Flash Supermatic, incorporating a built-in synchronizer, and using a Kodak Flash Holder for the bulbs.

focal length, in the case of a 1:1 scale. When the extension exceeds the focal length, the effective aperture of the lens is decreased. The necessary factor for exposure can be determined by applying the following formula:

$$\frac{(\text{Focal length} \times \text{extension})^2}{\text{Focal length}^2}$$

Example:

$$\text{FL} = 2''$$

$$\text{Extension} = 2''$$

So,

$$\frac{(2 \times 2)^2}{2^2} = \frac{16}{4} = 4$$

Therefore, an increase in extension of 2″ with a 2″ focal length lens requires an increase in exposure of 4 times.

If using standard Leica equipment and extension tubes, factors for each tube and focal length of objectives will be found in the Leica Manual.

In the case of a double extension plate camera, a scale should be affixed to show .5, 1, 1.5, 2 stops increase in aperture, so that, after determining the correct aperture by the exposure meter, the diaphragm can be opened the required amount for the particular extension employed.

From the above formula, it will be found that double extension requires an increase in exposure of four times, equal to two stops.

Items of Equipment.

The first essential for standardized photography is a suitable camera with which colour photographic materials can be used and one that can easily be adapted to many specialized spheres of work such as extreme close-up photography. The apparatus must not be cumbersome, but compact and built with precision. It should be possible to make a large number of exposures within a minimum period of time.

The Leica camera, with certain accessories, will prove admirable for general clinical photography. Sometimes a larger camera with ground glass focussing and double extension may be found desirable. A 3½″ x 2½″ camera in this case would perhaps be the best, for the colour transparencies produced could be used directly for standard lantern slides.

Other cameras that may be found suitable are the Contax, Exacta Reflex, Graflex 3½″ x 2½″. Only first-class lenses that are colour-corrected, etc., should be used. Most other roll-film cameras are of little use in scientific photography.

The following discussion will be confined to the use of the Leica and its accessories for scientific and technical photography. The Leica III A, B, or C should be selected. This is fitted with automatic slow speeds and will be found most useful.

A high-speed lens such as the 5 cm. f2 Summar or 5 cm. f2 Summitar is not essential, and the 5 cm. f3.5 Elmar will be found the best all-round objective for clinical photography.

the patient's head must be rigidly fixed: the head-piece of the dental chair will be quite satisfactory. This is necessary in order that the subject doesn't move out of focus while close-up photographs are being taken.

RETRACTORS.

Suitable retractors for photography are not readily available. Those used for clinical examination of the oral cavity are usually quite unsuitable.

Very good types of retractors are available from Down Bros. and Mayer & Phelps Ltd., 32/34 New Cavendish St., London, W.1. The retractors are made in various sizes and are constructed especially for photography—bright metal parts being sand-blasted. Reference should be made to *Photographic Aids to Clinical Dental Practice*, by J. M. Dyce.

LABORATORY SET-UP AND PROCEDURES.

Water Supply.

If it is intended to carry out one's own processing of colour photographic materials, water supply forms the greatest problem.

For the purpose of preparing solutions, only distilled water is permissible. Preparation should be carried out in glass containers, as contamination from heavy metals will cause serious fogging.

During processing, a continuous water supply, thermostatically controlled, is necessary in order to maintain the correct temperatures of the solutions. This is extremely important in the first development of colour films. In Ektachrome, only ½°F. above or below 68°F. is allowable, otherwise the results will prove quite unsatisfactory. Unless a constant supply of clean water at the right temperature is available, it would be better not to contemplate processing one's own colour materials.

Chemicals.

Only chemically pure materials should be considered. In preparing solutions, the mass of the constituents should be determined accurately, with a good chemical balance. This precaution is of little account in black-and-white photography but is of great importance in obtaining satisfactory results in colour.

Of all solutions, perhaps the most important is the first developer. This usually contains a silver halide solvent such as sod. thiocyanate, and this component must be accurately weighed.

Contamination of one solution with another must be avoided and stoppers of bottles must not be interchanged. Bleaching solutions must not be allowed to contaminate colour-developers, as these will oxidize with the formation of dye-stuffs.

Some colour-developing agents of the di-ethyl or di-methyl paraphenylene-diamine type are dangerous if allowed to come in contact with the skin. Always wear gloves or avoid contact with solutions. However, Kodak claims their colour-developer for Ektachrome has not this undesirable property, possibly being an ortho-substitution.

In the case of Kodak Ektachrome, the chemicals for processing are supplied by the manufacturer ready to dissolve in water. Although from time to time

The following exposure table may form a guide to colour photography with the flashlight:

Ektachrome Type B with C C 95 filter:

Make of Bulb	Type	Shutter	Distance-flash to subject	Aperture
Gen. Elec.	SM	open or 1/20 sec.	2 feet	f 5.6
Philips	PF 14	open or 1/20 sec.	2 feet	f 8

Kodachrome Type A with C C 15 filter:

Make of Bulb	Type	Shutter	Flashlight number
Philips	PF 14	open or 1/20 sec.	No. 25 for light subjects and surroundings. No. 18 for dark subjects and surroundings.

In order to find the correct aperture, the distance of the flashlight from the subject is divided into the Flashlight Number, e.g., at 2 feet from the subject with a flash No. of 18, the correct exposure will be obtained with an aperture of f 9.

The above exposures for Ektachrome Type B have been proved correct, using a Kodak Medallist and Kodak Flash Holder. Those given for Kodachrome Type A are correct when used with the Leica Synchronizer at 1/20 sec.

LIST OF SUGGESTED APPARATUS.

Leica III a, b or c fitted with a 5 cm. f 3.5 Elmar objective 9 cm. f 4 Elmar objective.

Leica Sliding Copy device with Magnifier.

45 mm. and 90 mm. Extension Tubes.

Lens hood.

Cable release.

Leica Synchronizer for flashlight.

Weston Master Exposure Meter.

Eastman Colour Temperature Meter with colour-compensating filters.

3¼" x 2½" Double Extension Camera such as Kodak Recomar or Ensign Cameo.

2 Kodaflector Units with Osram No. 2 Photofloods for Kodachrome Type A, or Philips Argaphoto 3200°K. for Ektachrome Type B.

Variable Transformer.

OTHER EQUIPMENT REQUIRED FOR DENTAL PHOTOGRAPHY.

A rigid stand is required for the camera and this must be capable of being swung into position without in any way obstructing the work of the operator. Tripods generally are not entirely suitable in a dental surgery. An upright stand with a heavy base and rigid cross bar to support the camera will be found better. One Australian firm manufactures such a stand for clinical photography. Alternatively, the camera may be supported on the bracket table. For oral work,

claims have been made and formulae published for processing Ektachrome, other than that supplied by Kodak, these have been apparently developed by people who did not understand the chemistry of colour photography involved. It is suggested that on no account should valuable film be processed in other solutions, as the results will prove quite unsatisfactory.

Developing Tanks.

Tanks for developing may be of glass or suitable stainless steel. For 3½" x 2½" Ektachrome, the Dallon Tank of stainless steel is very good. For 35mm. work, the Kodak Adjustable Tank of stainless steel or 1-litre pyrex glass beakers make suitable vessels for processing.

A complete series of tanks for first developer, hardener, washing, colour-developer, bleaching, clearing and fixing, make processing easier and lessen the danger of contamination. These should be surrounded by an outer tank of water circulating at the required temperature. If the room temperature is also controlled, the maintenance of the correct temperature in the baths will be facilitated.

Provided that one attends to details and strict routine, good and consistent results can be expected. Anyone who adopts a scientific attitude towards photography cannot help but secure excellent colour reproductions.

The necessary steps in processing will now be outlined and are as given by Kodak in a pamphlet accompanying the Processing Kit. For further information, refer to the booklet on Ektachrome, *i.e., The Kodachrome and Ektachrome* Book, 1947, and to *Kodachrome and Ektachrome from all Angles*, by F. Bond.

SUMMARY OF STEPS FOR PROCESSING.

KODAK EKTACHROME FILM.

Step	Solution or Procedure	Remarks	Temp. in °F.	Time in Mins.	Total Min. at end of Step.
1	First Developer	Temperature tolerance = ½ F. Agitate carefully according to instructions	68°	15	15
2	Rinse	Running water	65°-72°	1	16
3	Hardener	Room lights can be turned on after 3 mins.	66°-70°	5-10	21-26
4	Reversal exposure	Expose each side for 5 seconds, at 1 ft. from a No. 1 Photoflood Lamp. Do not wash until after exposure			Reset Timer to Zero
5	Wash	Running water	65°-72°	5	5
6	Colour Developer		66°-70°	25	30
7	Wash	Running water	65°-72°	5	35
8	Clear	Clearing and Fixing Bath. Save bath for use in Step 12	66°-70°	5	40
9	Rinse	Running water	65°-72°	1	41
10	Bleach		66°-70°	10	51
11	Rinse	Running water	65°-72°	1	52
12	Fix	Clearing and Fixing Bath	66°-70°	5	57
13	Wash	Running water	65°-72°	10	67
14	Remove water-droplets	Use Kodak Photo-Flo or wipe carefully	65°-72°	1	68
15	Dry	Same method as black-and-white films			

KODAK (A/SIA) PTY. LTD.

ANSCOCOLOR.

The processing of Ansco color may be carried out by the user and the steps are similar to Ektachrome. As already mentioned above, on no account try to process Ektachrome in Ansco solution or vice versa.

All solutions are made up by the person processing or can be purchased in ready prepared form, as in Ektachrome.

It is not intended to give the complete processing instructions here, but these can be found in *Colour Transparencies* by Leslie C. Thompson and the *Leica Manual* (1947).

These processes are known as reversal processes, because the film is firstly developed as a negative, then exposed to light and developed as a positive with dye-coupling developer.

It is important to give adequate exposure to light (photoflood, not daylight) and, as one cannot over-expose in this case and under-exposure will result in poor transparencies, it is advisable to be on the liberal side, providing the heat from the lamps does not result in the emulsion of the film melting.

The following formulae for processing Anscocolor film are taken from the Leica Manual:

First Developer—Ansco 502.

Warm water (not over 33°C.)	750.0 cc.
Metol	3.0 gms.
Sodium Sulphite (anhydrous)	50.0 gms.
Hydroquinone	6.0 gms.
Sodium Carbonate (anhydrous)	34.0 gms.
Sodium Thiocyanate	2.0 gms.
Potassium Bromide	2.0 gms.
Water to make	1 litre

Develop both Ansco Daylight and Ansco Tungsten Type film for 14 min. at 20°C.

Stop Bath—Ansco 858.

Water (not over 33°C.)	750.0 cc.
Acetic Acid (glacial)	10.0 cc.
Sodium Acetate	20.0 gms.
Cold water to make	1 litre

Immerse developed film for 1-2 mins. at 15.5°-24°C.

Hardener—Ansco 901.

Water (not over 33°C.)	750.0 cc.
Potassium Chrome Alum	30.0 gms.
Cold water to make	1 litre

Use for 4 minutes at 15.5°-24°C.

Wash for 3 minutes in running water not over 27°C.

Second exposure—1½ minutes each side of film, 3 feet from No. 2 Photoflood.

Colour Developer—Ansco 605.

Water (not over 21°C.)	750.0 cc.
Ansco Dicolamine	16.0 cc.
Sodium Bisulphite	1.0 gm.
Sodium Carbonate (anhydrous)	58.0 gms.
Potassium Bromide	1.0 gm.
Water to make	1 litre

Develop Daylight and Tungsten Type film for 16 mins. at 20°C. After colour development, immerse film in stop-bath for 1 minute with vigorous agitation, followed by hardener for 4 minutes.

Wash at least 5 minutes. This is a very important step, as any colour-developer not removed will oxidize when the film is placed in bleaching bath.

Bleaching Bath—Ansco 709.

Water (not over 33°C.)	750.0 cc.
Potassium Ferricyanide	60.0 gms.
Potassium Bromide	15.0 gms.
Dibasic Sodium Phosphate	13.0 gms.
*Sodium Bisulphate	6.0 gms.
Water to make	1 litre

Bleach for 8 to 10 minutes.

Wash for 3 to 5 minutes.

Fixing Bath—Ansco 800.

Sodium Thiosulphate	200.0 gms.
Water to make	1 litre

After fixation, wash for 10 minutes in cool water and hang up to dry. It is important to keep the film away from sulphur-dioxide fumes when drying.

CHEMICAL TONING.

The following formulae are taken from the Modern Enclopaedia of Photography:

Cyan Toner.

Bath A.

Pot. Ferricyanide	25.0 gms.
Sod. Carbonate (crys.)	7.0 gms.
Ammonium Nitrate	7.0 gms.
Sod. Chloride	10.0 gms.
Water to make	1 litre

*Not to be confused with Bisulphite.

Bath B.

Pot. Bromide	5.0 gms.
Glacial Acetic Acid	15.0 mls.
Ferric Alum	5.0 gms.
Water to make	1 litre

Bleach print in Bath A. Wash for 10 minutes, then tone in Bath B. Fix in 5 per cent. sod. thiosulphate. Rinse for 2 minutes clear in 1 per cent. sulphuric acid. Finally, wash for 10 minutes.

Yellow Toner.

Bath A.

Glacial Acetic Acid	25 mls.
Lead Nitrate	15 gms.
Pot. Ferricyanide	10 gms.

Bath B.

Pot. Bichromate	5.0 gms.
Water to make	1 litre

Ammonia added dropwise to convert orange colour to bright yellow. Bleach print in Bath A, then thoroughly wash and, afterwards, tone in Bath B.

Magenta Toner.

Bath A.

Nickel Nitrate	50.0 gms.
Potassium Citrate	150.0 gms.
Water to make	1 litre

Bath B.

Pot. Ferricyanide	22.0 gms.
Water to make	1 litre

Bath C.

Dimethyl Glyoxime (sat. soln. in alcohol)	100.0 mls.
Sod. Hydroxide (0.4 per cent. soln.)	100.0 mls.
Ammonia conc.	3.0 mls.
Water to make	1 litre

Bleach prints in equal parts of Baths A and B, slightly acidified with nitric acid. Wash thoroughly and tone in Bath C for 2-3 minutes; re-wash; fix in 5 per cent. sod. thiosulphate solution for 2 minutes, and finally re-wash.

The following Cyan Toner may also be used:—

Cyan Toner.

Kodak Formula T—12.

Ferric Ammonium Nitrate (green scales)	4.0 gms.
Oxalic Acid (crystals)	4.0 gms.
Potassium Ferricyanide	4.0 gms.
Water to make	1 litre

Dissolve each chemical separately in about 250 mls. of water, and filter before mixing together.

Immerse prints for 10-15 minutes until desired tone is obtained. Wash until highlights are clear.

DUFAYCOLOR.

Develop film in total darkness, with continuous agitation for 3¾ minutes at 65°F. in the following bath:

Developer.

Metol	6.5 gms.
Sodium Sulphite (anhydrous)	50.0 gms.
Hydroquinone	2.0 gms.
Sodium Carbonate (anhydrous)	37.05 gms.
Potassium Bromide	2.75 gms.
Potassium Thiocyanate	9.0 gms.
Water to make	1 litre

This developer may be used again for the second development (see later). Wash for 2 minutes.

Bleaching Bath.

Potassium Permanganate	2.0 gms.
Ammonium Persulphate	0.5 gms.
Water to make	1 litre
Sulphuric Acid (conc.)	10 mls.

Bleach with agitation in this bath for 3-5 minutes or for 1 minute longer than appears necessary to clear highlights.

White light may now be turned on.

Clearing Bath.

Potassium Metabisulphite	25.0 gms.
Water to make	1 litre

Rinse for ½ minute in the above solution. Wash for 5 minutes.

Second Exposure to Light.

Expose emulsion side of film for about 1 minute at about 18 inches from 100-watt lamp.

Re-development.

Use first developer for re-development, and then discard.
Wash for five minutes.

Hardening.

Harden in the following bath:

Chrome Alum	25.0 gms.
Water to make	1 litre

Wash in running water for 15 minutes before drying.

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EDITORIAL DEPARTMENT

CHOICE OF A GERMICIDE.

The importance of a careful evaluation of germicidal agents is often overlooked when a selection of an appropriate type is being made for use in the surgery. It is fortunate that most requirements can be satisfied by boiling or using the autoclave, but there are some instruments which can best be sterilized by using a suitable solution as a cold sterilizing agent.

Some of these agents may be highly toxic to the tissues or may corrode the fine, sharp edges of certain types of cutting instruments. On the other hand, certain brightly coloured dyes are used and, in general, they have too restricted an application and more often they require careful attention to concentration before they are effective.

A few of these are more effective when used in alcoholic solution and many of them take considerable time to produce any marked reduction in the potency of the infective material. A common error is the use of germicidal agents for long beyond the period when oxidation has rendered the solution more or less useless.

Whatever the agent used, all instruments should be thoroughly cleaned of blood and debris and, where a sharp edge is to be maintained, it should be refreshed on an oilstone and the oil removed with a suitable solvent; thus prepared, the instruments can be carefully placed in suitable containers with sufficient solution to cover them completely and the containers should be closed.

After the appropriate time, the instruments are removed, washed in sterile water and run through absolute alcohol; they may then be stored in sterile towels, cutting edges being protected by covering first with sterile cotton wool.

Instruments prepared in this way and stored in sterilized containers with tight-fitting covers may be readily transported from place to place or left ready for any emergency for a considerable period without fear.

It is not the intention here to deal at any great length with methods of preparing sterile instruments but rather to deal with some of the agents commonly used.

Recent studies* of the problem have revealed a wide variation in the capacity of certain well-known and frequently-used germicides.

Chemicals which satisfy requirements concerning toxicity and the corrosive action on metals are not likely to have much action on bacterial spores but, because of the possibility of contamination with the few pathogens that develop spores, it is recommended that, where possible, sterilization should be carried out by steam or hot air.

The capacity of disinfectants for long has been determined by means of the "phenol coefficient"—an artificial test, the limitations of which have long been recognised. Some investigators now use the so-called "infection-prevention test," in which a highly virulent culture of haemolytic streptococcus or a pneumococcus is used, against which the effectiveness of the disinfectant is tested *in vivo* by means of peritoneal implants in mice. Death of the animal with recovery of the infecting micro-organism from the heart's blood indicates failure. Some observers have shown that this method is much more sensitive than the cultural one for detecting bacteria which have escaped the action of the disinfectant.

In such a test it is most important that the animal be susceptible to the organism; in the case of tubercular infection, the mouse is not very susceptible and hence it is necessary to use some other animal or change the method of test. However, it is not intended to discuss this test except to mention this necessity for checking susceptibility to the particular organism under test.

Some results obtained recently have shown that, against pneumococcus, haemolytic streptococcus and mycobacterium tuberculosis, iodine in 2-3 per cent. solution saponated cresol and formaldehyde solution were effective. Phenol was relatively ineffective against the streptococcus, even in 4 per cent. solution. In aqueous solution, sodium ethyl mercuri thiosalicylate (Merthiolate) and nitromersol, N.F. (Metaphen) were relatively ineffective but, when benzyl alcohol was added to the Metaphen in a concentration of 4 per cent. by weight, this became a relatively good disinfectant, more particularly against the streptococcus. However, it should be noted that, where the concentration was only 1 per cent., it was much more active against the pneumococcus; benzalkonium chloride, U.S.P. (Zephiran) in 1 per cent. solution was effective against pneumococcus but vastly improved when made in tincture. Hydrogen peroxide in 3 per cent. solution had no effect against the two pyogenic cocci.

The general results of this study would indicate the need for care in selecting the disinfectant and also in using the appropriate solvent.

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*Prombo, Marjorie P. and Tilden, Evelyn B.—J.D.Res., 29:2, 108, 1950.

STANDARD MATERIALS.

In this issue we are pleased to have the opportunity of listing dental materials certified as conforming to the standards drawn up by the Standards Association of Australia.

Previous mention has been made of the work involved in these matters (D.J.A., 21:329, 1949) and the list which is now published, although only covering three Standards—dental mercury, dental amalgam alloy and zinc phosphate cement, represents considerable work of the members of various committees and the co-operation of the manufacturers and suppliers.

The Standards Committee of the Australian Dental Association by publishing this list does not undertake to endorse, certify or guarantee any dental materials; this is left as the sole responsibility of the manufacturer.

The profession can, however, play a most useful and important part by using this list as a guide when purchasing materials. The successful continuance of the work laid down by the Committee depends upon this co-operation from the profession and co-operation from various manufacturers who are willing to submit, from time to time, their products to careful test. As more manufacturers conform to this practice, so the profession can feel adequately safeguarded against the use of faulty materials and, what is of vital importance, the public is also afforded a considerable degree of protection.

Ultimately, the real safeguard for the public lies in the dentist's own hands: without skilful technique and the employment of proper basic principles, dental treatment will never attain a consistent and adequately high standard, but without satisfactory materials of consistently uniform quality no satisfying results can be obtained.

NOTE TO AUTHORS.

Authors are asked to note that synopses are now regarded as essential accompaniments to all scientific articles submitted for publication. This is the outcome of a decision made on the subject at the Scientific Information Conference held in London during July, 1948, during which it was agreed that synopses submitted by authors would save both time and money in producing "abstracting journals," which are of great service to scientific and technical bodies in Australia as well as overseas. Consequently, the Abstracting Services Committee was set up by the Royal Society to formulate agreed principles for summarising papers.

The Information Service of the Commonwealth Scientific and Industrial Research Organisation, which is responsible for abstracting most of the scientific literature published in Australia, is in thorough accord with these stated principles. At their request, we publish them herewith.

The synopsis should be a factual précis of the paper, drawing attention to all new information and to the main conclusions. It should be self-contained: it should not cite sections of the paper or illustrations by their numerical references in the text. If references to earlier work are essential, they should be cited as in the text; otherwise, they should be omitted.

The synopsis should contain the names of, or draw attention to, any new compound, mineral, species, and any new numerical data, such as physical constants. When giving experimental results, it should indicate the methods used; in the case of new methods, the basic principle, range of operation and degree of accuracy should be given.

The title of the paper is usually read as part of the synopsis. Thus, its repetition in the opening sentence should be avoided. If the title is insufficiently comprehensive, the opening should indicate the subjects covered and the objective of the investigation.

Abbreviated English should not be used, and the abstract should be written in the third person. Standard rather than proprietary terms are preferable.

There is no specific length recommended, but the synopsis should be concise and should not normally exceed 200 words.

Finally, careful revision is most important.

News and Notes

AUSTRALIAN DENTAL ASSOCIATION STANDARDS COMMITTEE

List of Certified Dental Materials, 15th July, 1950.

At the Annual Meeting of the Australian Dental Association, held in October, 1946, a motion was passed strongly approving of the principle of certification of dental products and resolving that representations be made to secure early action to this end. Subsequently, at the suggestion of the Director-General of Health, the Standards Committee of the Australian Dental Association was set up. After three years of activity this Committee is now in a position to issue its initial list of Certified Dental Materials.

The first fundamental item in such a plan must be the existence of official Australian Standards for Dental Materials. These specifications are being drawn up by the Standards Association of Australia at the request of the Australian Dental Association and the Commonwealth Department of Health. The first three Standards—those of dental mercury, dental amalgam alloy and zinc phosphate cement were recently adopted and work is proceeding on the drawing up of standards for other materials.

As the second step in the operation of the plan, manufacturers or importers are invited to certify to the Standards Committee that their products comply with the specifications. It would be manifestly impossible for the Committee to test every batch of every certified material. For this reason, the Committee has required that the manufacturer, on certifying a product, must not only guarantee that his product meets with specification requirements, but he must also furnish evidence that he maintains a testing programme adequate to ensure continual compliance of the product.

On receipt of application for certification of a new product, together with all the required data, the Standards Committee procures a sample through the regular trade channels, usually by asking a dentist to act as its agent. This sample is then tested for compliance with the requirements of the specification and, if everything is in order, the name of the product is added to the list of certified dental materials.

The continuation of any product on this list is contingent upon its maintenance at required quality. Surveys of all products on this list will therefore be made by the Standards Committee. At regular intervals samples will be procured on the open market and if, on test, it is found that a material no longer complies, it will be removed from the list and the manufacturer advised that his certification is no longer acceptable.

Thus, although the Standards Committee cannot test the entire production of dental materials, its certification plan calls for continuous testing by the manufacturer and check-tests by the Committee's representative (the Commonwealth Bureau of Dental Standards), thereby ensuring that a constantly high level of quality of the products on the list is maintained.

It should be clearly understood by both manufacturers and dentists that the Australian Dental Association Standards Committee cannot endorse, certify or guarantee dental materials. All such statements are solely the responsibility of the makers of the products concerned. The Standards Committee has adopted the standards of quality and asks manufacturers to guarantee their products to meet them.

Members of the profession are advised to use this initial list of certified products as a guide to their purchases. At intervals further lists will be published to include other products for which application has been made, and which have been found to comply with the relevant specification.

CERTIFIED DENTAL MERCURYS (A.D.S. No. T1):—

Mercury.	Manufacturer or Distributor.
A.D.P. Mercury	Mitchell Dental Supplies.
Ash Chemically Pure Mercury	The Amalgamated Dental Co. Ltd.
Bosch Mercury	Bosch Naylor Pty. Ltd.
Glover & Goode Dental Mercury	Glover & Goode Pty. Ltd.

CERTIFIED DENTAL AMALGAM ALLOYS (A.D.S. No. T2):—

Amalgam Alloy.	Manufacturer or Distributor.
Baker's Aristaloy	Baker Platinum, Ltd., London. (N.I.A. Investments Pty. Ltd.)
Bosch Alloy	Bosch Naylor Pty. Ltd.
Bosch 70% Alloy	Bosch Naylor Pty. Ltd.
Crompton Alloy (67%)	Crompton Dental Products.
Crompton 70% Alloy	Crompton Dental Products.
F. & G. 70% Alloy	Felton Grimwade Dental Co.
G. & G. 70% Alloy	Glover & Goode Pty. Ltd.
G. & G. Quick Setting Alloy (Standardised)	Glover & Goode Pty. Ltd.
Solila Alloy Quick Mixing	Amalgamated Dental Co. Ltd.

CERTIFIED ZINC PHOSPHATE CEMENTS (A.D.S. No. T3):—

Cements.	Manufacturer or Distributor.
Dalton's Zinc Cement	The Dalton Chemical Co.
De Trey's Cement	Amalgamated Dental Co. Ltd.

PERCY R. HOWE

When a man gives his name to a treatment he is often regarded as an immortal. This must be the case with Percy Howe, of silver nitrate fame. He has passed away at the green old age of 85. He qualified in 1889 at Philadelphia. Although the operative dentist associates his name with silver nitrate, research workers in vitamin deficiencies recognise him as one of the earliest and foremost in this work from the dental point of view. Howe was one of those versatile research workers to whom every department of his profession provided absorbing and enthusiastic interest. Pyorrhea, dental caries, root canal treatment, importance of first molars, salivary factor in dental caries, the effect of scorbutic diet upon the teeth, focal infection, pulp conservation, decalcification of teeth and bone and regeneration of bone through diet. In his last years this question of diet absorbed his attention. He was head of the research laboratory of the Forsyth Institution and director of the Infirmary in 1917. He was one of the three persons to receive the A.D.A.'s Award of Merit, and in 1948 he was made a Fellow in Dental Surgery of the Royal College of Surgeons of England.—B.D.J., 88:279, 1950.

MICROFILM SERVICE FOR LIBRARIES

We have pleasure in announcing that the Dental Journal of Australia has entered into an agreement with University Microfilms, Michigan, U.S.A., to make issues of the Journal available to libraries in microfilm form.

Under the plan, the library keeps the printed issues unbound for two to three years. At the end of this period or when the paper copies begin to wear out, the microfilm is substituted at a cost approximately equal to binding the volumes.

Sales are restricted to subscribers to the Dental Journal of Australia, and the film copy is distributed at the end of each year.

The microfilm is in the form of positive microfilm, and is furnished on metal reels, suitably labelled. Enquiries concerning purchase should be directed to University Microfilms, 313 N. First Street, Ann Arbor, Michigan, U.S.A.

WESTERN SUBURBS DENTAL GROUP
THIRD ANNUAL BALL

Following the success of the 1949 function, the Western Suburbs Dental Group again chose the Petersham Town Hall as the venue for their Third Annual Ball held on 1st June, 1950.

Those entertained by the President of the Group, Mr. R. G. Leeder and his wife, included Dr. E. R. Magnus, President of the New South Wales Branch of the Australian Dental Association, and Mrs. Magnus; Dr. J. S. Baird, President of the Dental Board of New South Wales, and Mrs. Baird.

During the evening Dr. and Mrs. Baird received the congratulations of those present on the occasion of their twenty-first wedding anniversary.

Members of the Group made the most of the opportunity to entertain their friends and colleagues; so, too, did office-bearers from the St. George Dental Association and the Eastern and Northern Suburbs' Dental Groups. The evening was made still more enjoyable by the excellent supper which was served continuously, the music and the attractive floor-show, the members of which concluded their presentation by demonstrating the American Square Dance and calling for volunteers to follow their example.

Happy have we met. Happy have we been. To our next merry meeting! —R.D.

FAR NORTH QUEENSLAND CONVENTION

Your attention is drawn to the fact that the Far North Queensland Sub-branch of the Australian Dental Association (Queensland) proposes to hold a Convention in Cairns about the middle of June, 1951.

The climate in the North at that time of the year is extremely pleasant as a rule, and many dentists from the South may wish to plan a holiday there.

Further details of the Convention will be available at an early date. Enquiries should be directed to I. S. Macdonald, Hon. Secretary, Far North Sub-branch, Australian Dental Association (Queensland), Dental Department, Cairns Base Hospital, Cairns.

NORTHERN SUBURBS DENTAL GROUP

Members are asked to note that the remaining general meetings of this group for the year will be held at 8 p.m. on Thursday, 12th October, 1950, and Thursday, 14th December, 1950, at the Mosman Hotel.

Keep these dates in mind!

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Association Activities

AUSTRALIAN DENTAL ASSOCIATION

(NEW SOUTH WALES BRANCH)

Extract from the Minutes of the Meeting of the Executive Committee held in the Council Room, B.M.A. House, 135-137 Macquarie Street, Sydney, on Monday, 19th June, 1950, at 7.15 p.m.

Present: Dr. E. R. Magnus, President, in the Chair; Dr. A. G. H. Lawes, Vice-President; Dr. F. E. Helmore, Vice-President; Dr. R. M. Cloutier, Honorary Treasurer; Dr. J. V. Hall Best, Mr. N. E. Edney, Mr. H. McD. Finnie, Mr. W. A. Grainger, Mr. R. Krauss, Mr. R. G. Leeder, Mr. R. Y. Norton, Mr. F. R. Reid, Mr. J. W. Skinner, Mr. Ralph Tompson, Mr. R. W. Wilson; Mr. C. D. Reynolds, Newcastle and Hunter River District Division; Dr. J. D. Oddy, South Coast Division; Dr. A. G. Rowell, Western Division.

Apology: Dr. J. D. Benson, North and North-west Division.

In attendance: Mr. Robert Harris, Secretary.

Minutes: The minutes of the meeting held 8th May, 1950, were signed as a correct record.

Report from Committee of the Honorary Officers:

Amendments to Federal Constitution: The President stated that a conference was to be held in Melbourne next weekend to discuss the amendments proposed by the various State Branches and that, in accordance with the direction of the Executive, the Committee of the Honorary Officers had given careful consideration to the proposals submitted and considered the question of voting powers was likely to be contentious.

It was resolved that Dr. Magnus and Mr. Edney be appointed delegates to this conference.

Dr. Terrell's Lecture Tour:

The Secretary reported that, following the recommendation made at the Conjoint meeting of the Executive Committee and the Delegates from Divisions that Dr. Terrell should lecture in three country centres only, Wagga Wagga, Newcastle, and Lismore, a letter had been received from Dr. Terrell intimating that he would be prepared to lecture in both the afternoon and evening on each occasion.

It was resolved that (1) Wagga Wagga, Newcastle, and Lismore be the centres for lectures by Dr. Terrell in his tour of the country districts of New South Wales; (2) two lectures be given by Dr. Terrell in Sydney, which all registered dentists can attend on the Monday following Congress week, one at 10.30 a.m. and the other at 8 p.m.; (3) the Dental Board of New South Wales be informed of Dr. Terrell's tour and the lectures in Sydney.

In this connection it was stated that all registered dentists in New South Wales would be advised of the scheduled tour of lectures and that admission would be by ticket.

It was suggested that Dr. Terrell could lecture in Wagga Wagga on Tuesday, in Newcastle on Thursday, and in Lismore on either Friday or Saturday.

Reports from Committees:

Newcastle and Hunter River District Division Meeting: Mr. Krauss, the Chairman of the Divisions Committee, reported that the Newcastle and Hunter River District Division would be holding a meeting on Friday, 23rd June, 1950, at which a representative from Watson Victor Ltd. would be the speaker.

Syllabus: It was reported that the Blue Mountains Division had made a request for a lecturer. It was resolved that permission be granted for Mr. T. R. Corbett to lecture to the Blue Mountains Division on 1st July, 1950.

It was also reported that the Southern Tablelands Division had requested permission for Dr. C. H. Graham to lecture at its meeting. It was resolved that permission be granted for Dr. C. H. Graham to lecture to the Southern Tablelands Division on 24th June, 1950.

Industrial Arbitration: Mr. Edney reported that no finality had been reached at the meeting held today in connection with the dental mechanics' claim for a new award and that a further meeting would be held on 26th June.

Membership:

New Members: It was resolved that the following dental practitioners whose applications were in order and who had paid the requisite subscriptions be admitted to membership of this State Branch as from 19th June, 1950:—

Carne, Evan Gwynne, B.D.S.; Crispin-Smith, Miss Monica, B.D.S.; Hastie, Peter, B.D.S.; Hollis, Joseph William Leigh, B.D.S.; Madden, Thomas William, B.D.S.; Mallard, Paul Laurence, B.D.S.; Martin, Eric Allan; Steele, Ian David, B.D.S.; Aroney, Victor, B.D.S.; Lynch, Eugene Philip, B.D.S. (admitted as from 1st July, 1950).

Restricted: It was resolved that the following members of this State Branch be granted restricted membership as from 1st January, 1950:—Doudney, Albert Arthur; Wade, Judith Brabazon, B.D.S.

Deceased: It was noted with regret that Dr. Howard Greenwell, of Killara, and Mr. Walter Lett, of Woy Woy, had died on 8th June, 1950, and 17th May, 1950, respectively.

Recommendations from Conjoint Meeting of Executive Committee and Delegates from Divisions held 5th June, 1950.

Dental Health Propaganda: On consideration being given to the following recommendations: (1) that it be recommended that a set of recordings be prepared by the Dental Health Education Committee to be circulated among the Divisions, who would then organise the broadcasting of same; (2) that it be recommended that the various Divisions appoint Committees at their next meetings to deal with the matters raised in this plan and that such Committees be authorised to go ahead with such items as are agreed to at this meeting, the Secretary reported that, on enquiries being made, it was found that although a number of broadcasting stations have apparatus for broadcasting of wire recordings they do not like this method for short broadcasts and that in transferring them from station to station they are likely to be damaged.

Country Conventions: It was resolved that the following recommendations from the Conjoint meeting be adopted: "(1) that this meeting is of the opinion that country conventions should be held in years other than those in which Australian Dental Association Congresses are held; (2) that the first of the country conventions be held at Armidale in 1951, preferably in the August University vacation."

With regard to the third recommendation in this connection: "(a) that Dr. Benson and Mr. Krauss be requested to form a committee to organise this Convention", it was agreed that this Executive should await formal application from the North and North-west Division for the holding of the Convention.

Consultation Fees for Dentists: The following recommendations were considered: "(1) that this meeting recommends to all Divisions a minimum consultation fee and a minimum fee for extractions; (2) that it be recommended to the Executive Committee that, in view of the inadequacy of existing dental fees, the Executive consider initiating propaganda among both the members of the profession and the general public with a view to improving the fees and the general introduction of consultation fees."

It was resolved (1) that no direction be given by this Executive as to an amount to be charged for a consultation fee. It was agreed that this was purely an internal Division matter; (2) that the question of initiating propaganda be referred to the Survey of Fees Committee.

Dental Journal of Australia: Consideration was given to the recommendation "that it be recommended that the Journal Committee consider giving more items of general interest in the *Dental Journal of Australia* and not quite so many of the highly technical articles which have recently appeared." It was resolved that this recommendation be adopted.

Correspondence:

Victorian Branch: A copy of letter dated 3rd January, 1950, from the Victorian Branch, despatched under cover of letter dated 25th May, 1950, by the Federal Office, was read, giving notice of intention to submit the following motion at the next meeting of the Federal Council.

"That 'Grant-in-aid', as previously outlined by the Victorian Branch, be incorporated in any future policy of the Association, in order to provide treatment for the children of parents who seek the services of private practitioners."

This letter was received.

Dental Assistants' Association: A letter, dated 31st May, 1950, from the Dental Assistants' Association requesting that lectures be delivered by dentists at their regular meetings, was read and received and the President stated that the question of a roster for this purpose would be looked into.

Frank Marshall Prize: A letter, dated 7th June, 1950, from the Registrar of the University of Sydney intimating that the Senate of the University had gratefully accepted the donation of £338/9/6 for the Col. Frank Marshall Prize, was read and received.

NORTHERN SUBURBS DENTAL GROUP

Office-Bearers, 1950-51.

President: Mr. L. J. Noone.

Vice-President: Mr. A. S. Henderson.

Honorary Secretary: Mr. A. Vern Barnett.

Honorary Treasurer: Mr. N. G. Moore.

Immediate Past President: Mr. F. Thearle.

Committee: Mr. L. S. McKern, Mr. J. Spencer, Dr. R. Moore, Mr. R. Tompson, Mr. A. Broadbent, Dr. Lothian Crane.

New Books and Publications

Dental Anatomy, by R. C. Zeisz and James Nuckolls, St. Louis, 1949. C. V. Mosby Co. Price £7 7s. 0d. *Our copy by courtesy of W. Ramsay (Surgical) Pty. Ltd., Melbourne.*

In their preface the authors stress the need for a complete account of the anatomy of the teeth, a complete presentation of it, and a complete understanding of it. This is followed by an explanation that they have examined some

thousands of teeth and selected a composite picture for the description of an ideal tooth of each class. If we can trust their assesment of features, such a method might provide an easy way of coping with a difficult subject but scarcely deserves the qualification "complete."

A most meticulous, wordy and, I should think, unmerited description is given of these "ideal teeth." Apparently the shallowness of such treatment was realised to some extent, because statements about variability are made, but these are very incomplete and quite inadequate for any attempt to present dental anatomy.

Notes on the eruption of the teeth might prove of some use in a nurses' handbook but, in a publication of this sort intended to enlighten students and practitioners of dentistry, they constitute over-emphasis on rudimentary points.

The glossary provided is in keeping with the elementary treatment of the subject, giving as it does pronunciations for such common words as *wall, border, surface, pit, root, lobe* and other simple terms.—A.C.G.

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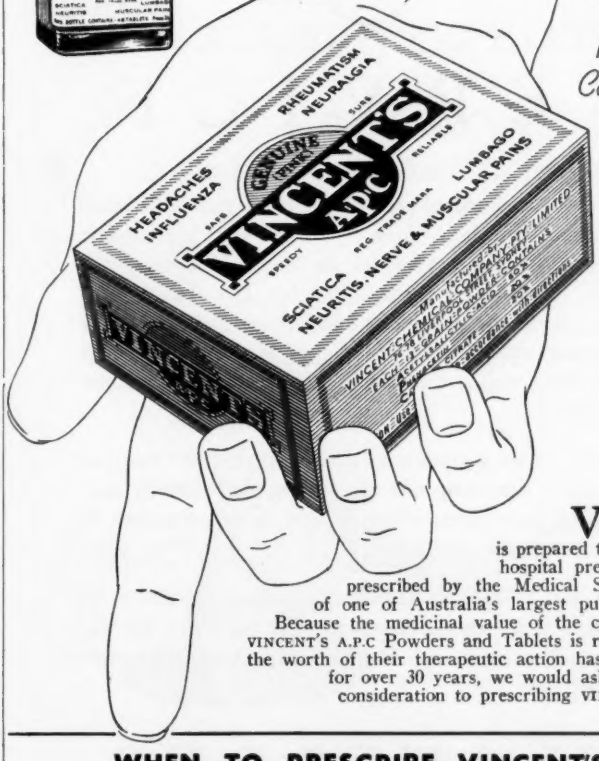

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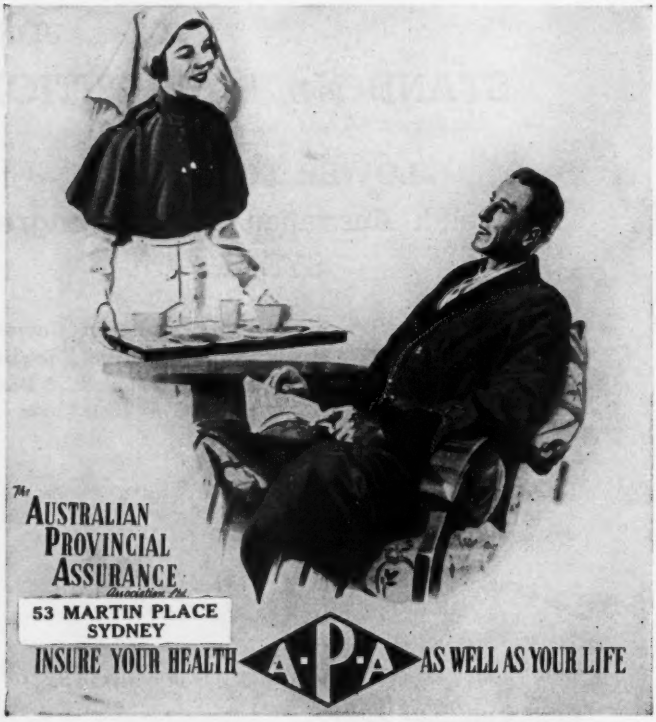
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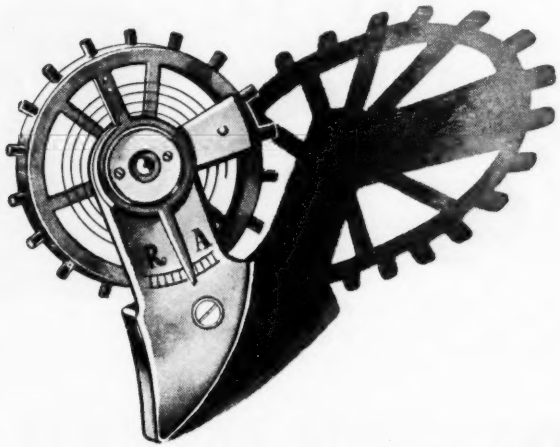

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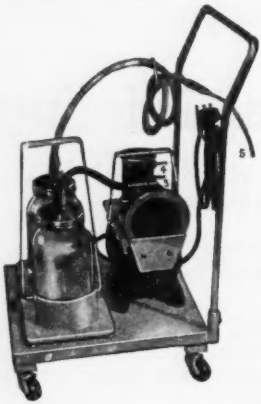

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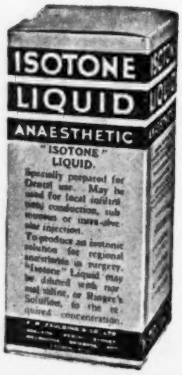

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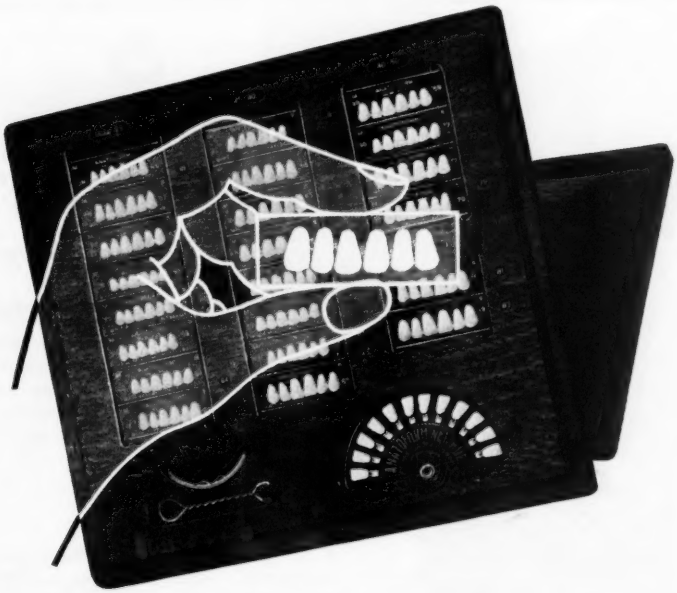

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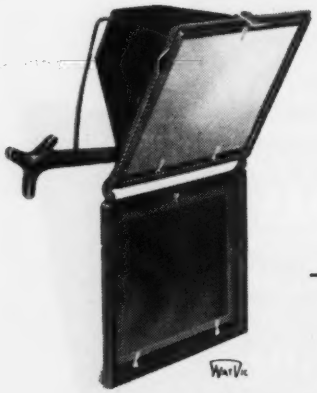
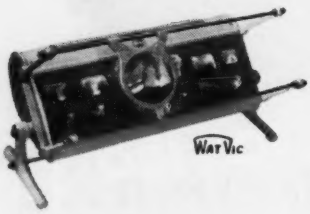


DENTAL X-RAY EQUIPMENT

for the Modern Surgery

"Safelight" Combination Illuminator

Designed to provide an illumination which will not fog the film during darkroom procedure, and as a film-viewing illuminator after processing. The changeover is effected by folding back the "Safelight" to expose the flashed opal glass for film viewing.

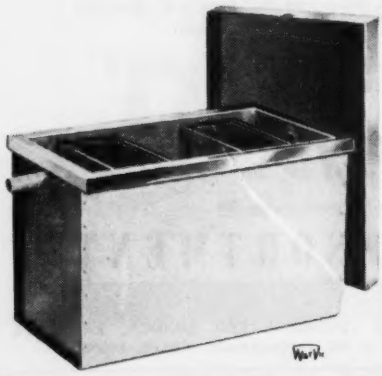


WatVic Dentoscope

A convenient desk illuminator for reading dental radiographs, either directly or through a 3in. magnifier. The magnifier is adjustable to suit the convenience of the operator, and slides laterally for magnification of individual films.

Film Dispenser

A safe storage unit for dental films. Of heavy bronze, it is X-ray proof, holding unexposed and exposed films in two compartments. Without opening the door, unexposed films may be individually removed and, after exposure, "posted" into a slot to await processing.



Film Processing Set

Includes two WatVic Incorroda Dental Tanks—for developing and fixing of the film—mounted in a Monel metal container arranged for connection to water supply. Equipped with a light-tight lid.

Write, call, telegraph or telephone for further particulars.

WATSON VICTOR LIMITED

Branches in all Principal Cities throughout Australia and New Zealand.

A harmonious pattern of contrasting form and color brought to its ultimate of beauty by a transparent cap of dew.

No better formula to follow...

Dr. Myerson's teeth are made to follow nature's own formula where beauty of form is combined with nature's own dentine colors showing softly and lustrously through a transparent enamel. This remarkable duplication of nature's beauty is integrated with maximum ceramic strength. This masterpiece has been imitated the world over but *never equalled.*

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NOVUTOX, in 2 oz. bottles

NOVUTUBES, 2% and 3% in boxes of 100

FOR YEARS HAVE RETAINED THEIR HIGH STANDARD AS DENTAL ANÆSTHETICS

Good news for the users of

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THIS UNEXCELLED IMPRESSION MATERIAL IS AVAILABLE FROM OVERSEAS AGAIN

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This "Good Teeth" Certificate featuring the Walt Disney characters, has been specially designed for you to give to your child patients after treatment or regular inspections

Issued by the makers of **S.R.** *Toothpaste*
If you have not already received an issue of these certificates or require a further supply, just fill in the coupon below and forward to "Certificate", Box 1590, G.P.O., Sydney.

Free!

Please forward supplies of the S.R. "Good Teeth" Certificate to

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with the added features of —

● **Better Absorption**

1. Rapid disintegration.
2. Use of a calcium salt readily soluble in the acid stomach secretions.

● **Iron and Vitamin B1**

Added to enhance the therapeutic value of the tablet as the daily requirements of these factors are markedly increased during pregnancy and are often difficult to meet by dietary measures.

'Calvita'

EACH TABLET CONTAINS

Tri Calcium Phosphate	grs. 7½. (0.5 gm)
Ferrous Sulphate	grs. 1/6 (10 mg.)
Vitamin B1	333 int. units (1 mg.)
Vitamin D	500 int. units

A Nicholas Ethical Product

C.A.

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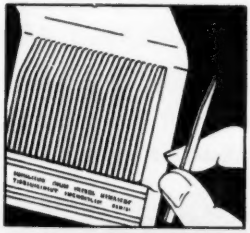
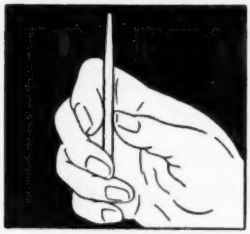
INTER-DENS

Patent Applied For Reg. No. 79345

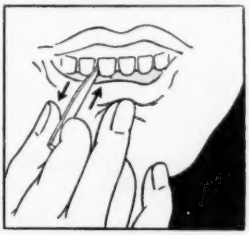
Firm Gums — Healthy Teeth!



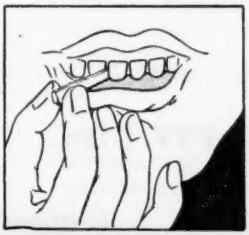
- MEDICATED GUM MASSAGERS FINISH WHAT THE TOOTHBRUSH LEAVES UNDONE.



- INDISPENSABLE FOR TREATMENT OF ALL GUM CONDITIONS.



- " INTER-DENS " ARE OBTAINABLE AT ALL CHEMISTS AND FROM DENTAL DEALERS.



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- 3-colour assortment, 52/-; 10-colour assortment 159/-

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CLINICALLY-PROVED DENTAL HAEMOSTATICS

. . . For Positive Control of Haemorrhage and Relief of Post-Operative Pain & Soreness

REASONS WHY you may prescribe or use CO-AG and CO-AG-SED with CONFIDENCE

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FOR PREVENTION AND TREATMENT OF DENTAL HAEMORRHAGE

CO-AG and CO-AG-SED are indispensable to the busy practitioner. They are available from Chemists and Dental Depots.

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CO-AG-SED
TO RELIEVE DENTAL PAIN AND CONTROL HAEMORRHAGE

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HELP THOSE WHO HELP YOU

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AUSTRALIAN MILITARY FORCES

VACANCIES FOR DENTAL OFFICERS

Applications are invited from legally qualified male dental practitioners for appointment to short service commissions in the Australian Regular Army as dental officers.

The terms of appointment are as follow:

(a) Duration of appointment: Two years. Applicants may elect to serve for one additional period of two years.

(b) Rank on commencement: Captain.

(c) Pay and allowances: The following schedule shows the daily rates of pay and allowances:

Detail	Officers not eligible for marriage allowance		Officers eligible for marriage allowance		
	Living in Camp	Living out of Camp	Living in Camp	Living at Home	Living out of camp and away from Home
1. Rate of pay	39/9	39/9	39/9	39/9	39/9
2. Uniform allowance ..	1/3	1/3	1/3	1/3	1/3
3. Marriage allowance ..	—	—	4/9	4/9	4/9
4. Provision allowance ..	—	—	—	4/–	—
5. Separation allowance	—	—	3/–	—	3/–
6. Living-out allowance	—	6/3*	—	—	9/–
	41/–	47/3	48/9	49/9	57/9

* 7/6 per day is payable for the first 30 days.

In addition to the rates set out above, an increment of 3/- per day is payable after two years' service, and a further 3/- per day after 4 years' service in the rank of Captain. (Note: Applicants with previous full-time service in the rank of Captain or equivalent may count such previous service for the purpose of computing these increments.)

(d) Gratuity:

(i) A gratuity at the rate of £125 per annum will be payable on completion of the total period of service (i.e., either two or four years).

(ii) In the event of a dental officer's death or total incapacity (not due to causes within his own control) the gratuity of £250 for a dental officer appointed for two years, or £500 for a dental officer appointed for a further two years, will be paid either to the wife and/or children in the case of death, or to the officer in the case of total incapacity.

(iii) In the event of the officer's partial incapacity (not due to causes within his own control), a proportionate gratuity pro rata to the length of his service will be paid to the officer.

(e) Retirement Benefits Fund: Dental officers serving on short service commissions will be required to contribute to the Defence Forces Retirement Benefits Fund.

(f) Uniform: An initial issue of clothing and necessaries will be free.

(g) Medical Standard: Applicants will be required to pass the approved medical examination.

Applications should be made in writing to THE SECRETARY, Department of the Army, Victoria Barracks, MELBOURNE, S.C.1.

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NOVUTOX

Self-Sterilising Local Anaesthetic

for

RAPID, DEEP & LASTING

ANAESTHESIA

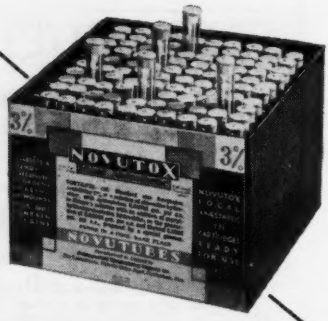
2% NOVUTUBES

for routine dental procedures

3% NOVUTUBES

for difficult extractions

For those cases in which more rapid onset with profound depth and very prolonged anaesthesia is required, the Dental Surgeon will appreciate the value of NOVUTOX 3% Self-Sterilising Local Anaesthetic which provides completely efficient pain control for the longest dental operations.



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'STERADENT' is completely safe for all dentures, including acrylics.

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